Space Systems Academic Group | Ferroelectricity Newsletter

1994

Ferroelectricity Newsletter / v.2:no.3 Summer 1994

Monterey, California, Naval Postgraduate School

Ferroelectricity Newsletter

A quarterly update on what's happening in the field of ferroelectricity

Volume 2, Number 3 Summer 1994

WHAT IS THE CONFERENCE FORMAT OF THE FUTURE?

If the increase in the number of pages of the ***Ferroelectricity Newsletter*** is any indication of the growth in the field itself, the question in the editorial of last issue -- **"Will 1994 become a banner year in the annals of ferroelectricity?"** -- might be answered affirmatively. The list of oral and poster presentations of ISAF 94 in addition to the first comprehensive report on what's happening in Japan in the field of ferroelectricity, an excellent piece prepared by **Pierre-Yves Lesaicherre** of NEC Corporation, swelled the newsletter from the previous 12 pages to 24.

The number of scientific contributions in the last few years has sharply increased, and if anything, this trend has intensified in the last few months.

On the practical side, this fortuitous phenomenon has created a difficulty when it comes to organizing conferences. It is almost impossible to arrange massive parallel sessions to everybody's satisfaction. Certain areas are bound to get shortchanged in the process.

Fortunately, there is a solution to this problem. If we look at the ratio of oral to poster presentations at this year's **IEEE International Symposium on the Application of Ferroelectrics**, we see that poster sessions far outnumber oral presentations. **Poster sessions** have the advantage of accommodating more papers in a way that makes it easier for participants to focus on their particular research, providing ample time for one-on-one discussions with authors in an informal environment.

In addition, poster sessions give authors more freedom in presenting their material. Poster sessions incorporate the advantages of a lecture and an exhibition, and there is no time pressure. If poster sessions are afforded the first-class position they deserve, oral presentations at plenary sessions can concentrate more on breakthroughs and overviews.

The future will tell which conference format will prevail. We invite all of you to give us your ideas on this subject. We will report on your feedback in the Winter issue.

Rudolf Panholzer
Editor-in-Chief

IN THIS ISSUE

Ferroelectricity Newsletter

Volume 2, Number 3
Summer 1994

The *Ferroelectricity Newsletter* is published quarterly by the Naval Postgraduate School, Space Systems Academic Group, Monterey, California, with the support of the Advanced Research Projects Agency (ARPA) and the Office of Naval Research (ONR).

Prof. Rudolf Panholzer
Editor-in-Chief
Dr. Hannah Liebmann
Managing Editor

Please direct inquiries to
Hannah Liebmann
500 Glenwood Circle, Suite 238
Monterey, CA 93940-4724
Phone (408) 649-5899
Fax (408) 655-3734

ISAF 94 PAPERS

In this issue we are listing the papers delivered at the ***Ninth International Symposium on the Application of Ferroelectrics (ISAF '94)*** *from 7-10 Aug 94 at The Pennsylvania State University, University Park, PA.*

0-1 Applications of Ferroelectrics: Past, Present, and Future. *L.E. Cross*

Piezoelectrics

1A-1 Ferroelectric Tungsten Bronze Oxides: A Case Study of Optoelectronic Materials. *R.R. Neurgaonkar, W.K. Cory, and J.R. Oliver*

1A-2 Novel Microwave-Hydrothermal Synthesis of Electroceramic Powders. *S. Komameni*

1A-3 Morphotropic Phase Boundary and Microstructure of Low-Temperature Sintered PZT Ceramics With $BiFeO_3$ and $Ba(CuO.5W0.5)O_3$. *K. Murakami, N. Okada, D. Dong, and S. Kaneko*

1A-4 Development of New Piezoelectric Ceramics With Bismuth Perovskites. *T. Takenaka, M. Yamada, and T. Okuda*

1B-2 Aging Properties of $Pb(Mg1/3Nb2/3)O_3$ Based Relaxor Ferroelectrics. *N. Ichinose*

1B-3 Local Atomic Structure of PLZT. *S. Teslic and T. Egami*

1B-4 Dielectric and Brillouin Scattering Anomalies in an $Na1/2Bi1/2TiO_3$ (NBT) Relaxor Ferroelectric Crystal. *V.H. Schmidt, C.-S. Tu, and L.G. Siny*

1B-5 Polarization Dynamics in Relaxor Ferroelectrics. *J. Toulouse, R. Pattnaik, and B.E. Vugmeister*

1B-6 Effects of Fluorine on PZT Materials With Oxygen Vacancies. *L. Eyraud, P. Eyraud, D. Audigier, and F. Eyraud*

1B-7 Piezoelectric Ceramics With the Large Anisotropy of Piezoelectric Coefficients. A Review. *A.V. Turik and V. Y.Topolov*

--continued on page 3

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS

Piezoelectrics

P1-1 Low Temperature Synthesis and Dielectric Properties of Lead Titanate by a Hydrothermal Method. *J. Moon and J.H. Adair*

P1-2 Simple Aqueous Chemical Synthesis of Barium and Lead Titanates. *A.V. Prasado Rao and M. Suresh*

P1-3 Synthesis and Its Chemical Process of $PbTiO_3$ Ultrafine Powders by Sol-Gel. *Qitu Zhang, Zhiqi Zhang, Dawei Shen, Wanrong Xue, Peiwen Lu*

P1-4 The Experiment Technique of $PbTiO_3$ Ultrafine Powders Prepared by Sol-Gel. *Qitu Zhang, Xuping Li, Peiwen Lu, Wanrong Xue*

P1-5 A New Method to Deagglomerate $PbTiO_3$ Ultrafine Powders. *Sasa Wang, Pingping Jia, Liangying Zhang, Xi Yao*

P1-6 Hydrothermal Preparation and Fabrication of Lead Zirconate-Titanate (PZT) Ceramics. *J.P. Witham, P. Ravindranathan, J. Dougherty*

P1-7 Fine PMN Powders Prepared from Nitrate Solutions. *Yoshio Yoshikawa*

P1-8 Combustion Synthesis of Barium Titanate Powders of Ultra-Fine Particle Size. *S.P. Ostrander, W.A. Schulze*

P1-9 On the 'Construction' of Piezoelectric Materials with a Prescribed Anisotropy in Piezoelectric Parameters. *L.D. Grineva, G.M. Akbaeva*

P1-10 Phase T, x-Diagram of $Pb_{1-x}Ca_xTiO_3$ Single Crystals. *V.V. Eremkin, V.G. Smotrakov, L.E. Balyunis, S.I. Shevtsova*

P1-11 Effect of Calcia Additions on the Electromechanical Properties of Samarium-Modified Lead Titanate Ceramics. *W.R. Xue, P.W. Lu, W. Huebner*

P1-12 Effects of Lanthanum Doping on the Grain Size and Piezoelectric Properties of Lead Titanate Ceramics. *P. Talwar, R.P. Tandon, Abhai Mansingh*

P1-13 Structural and Thermal Study of $Pb(Zr,Ti,Ce)O_3$ Ceramics. *E. Ching-Prado, R.S. Katiyar, Ajay Garg, D.C. Agrawal*

P1-14 The Influence of Processing Parameters on the Physical Characteristics of Doped Lead Titanate Ceramics. *A. Ahmad, T.A. Wheat, A.G. McDonald, S.E. Prasad, S. Varma*

P1-15 PZT Ceramics from Hydrothermally Synthesized Powders. *C.H. Lin, S.C. Pei*

P1-16 Fabrication and Properties of High Density, Fine-Grained PZT Ceramics Using a Post Sintering HIP Treatment. *C.E. Millar, B. Anderson, W. Wolny, J. Ricote, L. Pardo*

P1-17 Ferroelectric Solid Solutions with Low Coercive Force for Storage Applications. *G.M. Akbaeva, A.Ya. Dantsiger, O.N. Razumovskaya, Ya. V. Martinyuk, G.I. Kleto*

P1-18 A Study on the Sintering Mechanism of PZT-Based Piezoceramics. *P.W. Lu, W.R. Xue, W. Huebner*

1-19 Characterization of Chemically Reduced PLZT Ceramics. *G. Li, E. Furman, G. Haertling*

P1-20 Simultaneous Influence of A1203 and Li_2O on the Properties of Multicomponent Modified $PbTi_{0.53}Zr_{0.4703}$ Ceramics. *S.P. Yordanov, A.I. Zheglova, Yu.M. Poplavko*

-- continued on page 3

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 2

P1-21 Induced Phase Transition in Functional Ceramics and Their Applications. *Y.L. Wang, R.B. Liu*

P1-22 Effect of Barium Doping on PLZT Ceramics. *K. Trinath, N.S. Prasad, K.V.S. Raman, A. Bhanumathi*

P1-23 Electric Field Assisted Hot Forging of Piezoelectric. *P.A. Fuierer, A. Nichtawitz*

P1-24 Fabrication of Piezoelectric Ceramic Fibers Using Sol-Gel Technology. *R. Meyer, J.P. Witham, S. Yoshikawa*

P1-25 Spray Pyrolysis Synthesis of Lead Magnesium Niobate Relaxor Ferroelectric Powders. *Jeffrey G. Marx, Wayne Huebner*

P1-26 Microstructure Effects on the Electromechanical Properties of PZT-Ceramics II: TEM and Conductivity Analysis. *W. Huebner, W.R. Xue, P.W. Ku*

P1-27 Investigation of the Phase Diagram of the $PbTiO_3$-$BiFeO_3$ System. *P.W. Lu, W.M. Zhang, W.R. Xue, S.J. Tu, W. Huebner*

P1-28 Effect of Processing on Surface Acoustic Wave Properties of a Modified Lead Titanate Ceramic. *C.E. Miller, L. Pedersen, L. Pardo, J. Ricote, C. Alemany, B. Jimenez, G. Feuillard, M. Lethiecq*

P1-29 Determination of the Elastic Modules sE13 of Piezoceramic by the Method of Three Resonances. *M. Bogush, S. Kramarov. V. Madorsky*

P1-30 Piezoceramic Materials with Very Large Anisotropy of Piezoelectric Coefficients: Physical Aspects of the Problem. *A.V. Turik, V.Yu. Topolov*

P1-31 Averaging Physical Constants and the Problem of Connection Between Piezoelectric Properties of Single-Crystal and Ceramic Ferroelectrics. *A.V. Turik, V.Yu, Topolov, A.I. Chernobabov*

P1-32 Development of Piezoelectric Ceramics for Traveling Wave Motors. *W. Huebner, M.R. Reidmeyer, W.R. Xue, D. Stutts, J. Cummings, C. Mentesana*

P1-33 A Tunable Piezoelectric State in Regular Ferroelectrics and Relaxor Ferroelectrics. *Q.M. Zhang, J. Zhao, T. Shrout, N. Kim, L.E. Cross, A. Amin, B.M. Kulwicki*

P1-34 Stabilization of Characteristics and Making Allowance for Losses in Designing of Piezoelectric Devices. *A. Gorish, O. Kramarov, S. Kramarov, V. Madorsky, V. Mitko, Ur. Ustinov*

P1-35 Surface Recovery of PZT Thin Plate. *M.C. Chang, S.Y. Cheng, Y.C. Yu*

P1-36 Model of Anisotropic Thermoelectroelastic Medium with One-Dimensional Inhomogeneity. *A.A. Kuprienko*

P1-37 Switching Time of Ferroelectrics with Free Surface. *V.D. Kugel, G. Rosenman*

P1-38 Electromechanical Properties ofo Rainbow Devices. *E. Furman, G. Li, G.H. Haertling*

P1-39 Microstructural Effects on the Electromechanical Properties of PZT-BF Ceramics: I. *W. Huebner, W.R. Xue, P.W. Lu*

-- continued on page 4

ISIF 94 PAPERS

cont.

Piezoelectrics, cont.

1C-1 Processing and Performance of Injection Molded Piezoelectric Composite Transducers. *L.J. Bowen*

1C-2 IntegratedMicroelectromechanical Systems Technology Based on Ferroelectric Thin Films. *D.L. Polla, P. Schiller and L.F. Francis*

1C-3 Development of 1-3 PZT-Polymer Composite for Low-Frenquency Acoustical Applications. *C.Richard, R.Y. Ting, and C. Audoly*

1C-4 Fine-Scale, Large-Area Piezoelectric Fiber/Polymer Composites for Transducer Applications. *S.M. Ting, S.S. Livneh, V.F. Janas, and A. Safari*

1C-5 3-3 Composite Hydrophones From Distorted Reticulated Ceramics. *M.J. Creedon, S. Gopalakrishnan, and W.A. Schulze*

IC-6 Effects of Finite Dimensions in Piezocomposite Transducers. *W. Cao, W.K. Qi, Q.M. Zhang, and L.E. Cross*

1C-7 Piezoceramic-Polymer Composite as Thickness Resonance Mode Transducers: Dynamic Aspect and Effects of Heterogenous Structure. *Q.M. Zhang, Y. Shui, X. Geng, W. Cao, and L.E. Cross*

1C-8 High Pressure Applications of Ferroelectric Polymers. *F. Bauer*

1C-9 High Frequency Dielectric and Electromechanical Properties of Ferroelectric Nylons. *L.F. Brown, J.I. Scheinbeim, and B.A. Newman*

1C-10 Dependence on Supermolecular Structure and on Charge Injection Conditions of Ferroelectric Switching of PVDF and its Blends With PMMA. *M. Stein and B.-J. Jungnickel*

1D-1 Electromechanical Characteristics of PZT Under High Vibration Level. *S. Takahashi, S. Hirose, K. Uchino, and K.Y. Oh*

-- continued on page 4

ISIF 94 PAPERS

cont.

1D-2 Nanocomposite With Porous Silica Matrix for Electronic and Optoelectronic Applications. *Y. Xi*

1D-3 Typical Characteristics of a Piezoelectric Ceramic Material for Squeeze Igniters. *L.Eyraud, P. Eyraud, F. Eyraud, P. Gonnard, M. Troccaz, D. Audigier, N. Glissa, and M. Sprumont*

1D-4 Investigation on Piezoelectric Ceramics with High d33, d31 for a New Type of Rotational Stepper Motor. *Z. Gui, W. Zhong, S. Dong, L. Li, and X. Zhang*

1D-5 The Dielectric, Piezoelectric and Hydrostatic Properties of PLZT Based Rainbow Ceramics. *S. Sherrit, H.D. Widerick, B.K. Mukherjee, and G.H. Haertling*

1D-6 Nonlinear Stress-Strain Behavior of Piezoelectric Ceramics Under Tensile Loading. *T. Tanimoto, K. Yamamoto, and T. Morii*

Thin Films

2A-1 Preparation and Properties of Thin Layer Dielectrics by Sol-Gel Processing. *D.A. Payne*

2A-2 A Review of Structure-Processing-Property Relations for Ferroelectric Thin Films for Nonvolatile Memories. *A.I. Kingon, H. Al-Shareef, D.J. Lichtenwalner, R. Dat, and O. Auciello*

2A-3 A Simple Unified Analytic Model for a Ferroelectric Thin Film Capacitor and Its Application for Nonvolatile Memory Operation. *D.-Y.D. Chen, M. Azuma, L.D. McMillan, and C.A. Paz de Araujo*

2A-4 Stresses in Pt/PZT/Pt Capacitors for Integrated Ferroelectric Devices. *G.A.C.M. Spierings, G.J.M. Dormans, W.G.J. Moors, M.J.E. Ulenaers, and P.K. Larsen*

2B-1 Excimer Laser Ablation of Ferroelectric Oxide Thin Films. *S.B. Krupanidhi*

-- continued on page 5

ISAF 94 PRESENTATIONS

ISAF 84 POSTER SESSIONS -- continued from page 3

P1-40 Evaluation of Barium and Nioblum Doped PZT Ceramics for Underwater Hydrophone Applications. *K. Trinath, B.S. Sarma, N.S. Prasad, A. Bhanumathi*

P1-41 Increased Operating Temperature Range in La-Modified Pb(Mg1/3 Nb2/3)O3-PbTiO3 Relaxor Ferroelectric-Based Transducers. *J.T. Fielding, Jr., T.R. Shrout, S.J. Jang*

P1-42 Sample Aspect Ratio Influence on the Shear Coefficients Measurements of a Piezoelectric Bar. *N. Aurelle, D. Roche, C. Richard, P. Gonnard*

P1-43 Technology of Preparation and Properties of Anisotropic PbTiO3-Based Piezoceramics. *L.D. Grineva, O.N. Razumovskaya, V.A. Servuli, R. Molchanova*

P1-44 On Elastic Dipoles in Li Metaniobate Ceramics. *L.A. Reznitchenko, E.I. Bondarenko, A.M. Klevtsov*

P1-45 Temperature Stability of Resonance Frequency of Filter Materials Obtained by Different Techniques. *S.V. Gavrilyatchenko, A.Ya. Dantsiger, L.A. Reznitchenko, O.N. Razumovskaja, A.M. Klevtsov*

P1-46 Data Bank on Properties and Applications of Ferro- Piezoelectrics Materials (FPCM). *A.Ya. Dantsiger, L.A. Reznitchenko, O.N. Razumovskaja, S.I. Dudkina, N.V. Dergunova, S.V. Gavvrilyatchenko, R.U. Devlikanova, A.P. Naumov*

P1-47 High-Efficiency Transducers for Acoustic Diagnostics on the Basis of Novel Anisotropic Piezoceramic Materials. *V.M. Shikhman, L.D. Grineva*

P1-48 High-Efficiency Ferro-Piezoceramic PCR-Type Materials for Various Applications. *A.Ya. Dantsiger, O.N. Razumovskaya, L.A. Reznitchenko, S.I. Dudkina, S.V. Gavrilyatchenko, N.V. Dergunova*

P1-49 Piezoceramic Materials for Filters with Large Guaranteed Decay. *S.V. Gavrilyatchenko, A.Ya. Dantsiger*

P1-50 Piezoceramic Materials for Filters for Varions Purposes. *S.V. Gavrilyatchenko, A.Ya. Dantsiger, L.A. Reznitchenko, O.N. Razumovskaja*

P1-51 Equivalent Circuits of Electronic Ceramics. *Wang Long-Ling*

P1-52 On the Specific Features of Anisotropy in Piezoelectric Properties of High-Temperature Ferroelectric Ceramics. *L.A. Reznitshenko, E.I. Bondarenko*

P1-53 Mechanical Stresses and Three-Phase States in Ferroelectrics and Related Materials. *V.Yu. Topolov, A.V. Turik*

P1-54 The Origins of Electromechanical Responses in Polyurethane Elastomers. *H. Wang, Q.M. Zhang, L.E. Cross, R. Ting, C. Coughlin, K. Rittenmyer*

P1-55 Theoretical Equations for Dielectric, Elastic and Piezoelectric Constants of Diphasic Composite Changing its Connectivity from 3-0 to 0-3 Via 3-3. *Hisao Banno*

P1-56 Piezoelectric Composites: Thermal Stabilization and Improvement of Properties. *L.N. Syrkin, E.T. Kancherova, N.N. Feoktistova*

-- continued on page 5

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 4

P1-57 Piezoelectric Properties of 1-3 Composites of PZT 4 in P(VDF-TrFE) Copolymer. *K.W. Kwok. H.L.W. Chan, C.L. Choy*

P1-58 Study of PZT4/VF2/VF3 Piezoelectric 0-3 Composites. *H.L.W. Chan, Y. Chen, and C.L. Choy*

P1-59 Characterization of PZT Hollow-Sphere Transducers. *J.T. Fielding, Jr., D. Smith, R. Meyer, Jr., R.E. Newnham*

P1-60 Effects of Face Plate and Edge Strip on Piezoelectric Hydrostatic Response of 1-3 Composites. *J. Zhao, Q.M. Zhang, W. Cao*

P1-61 Fabrication 2-2 Connectivity PZT/Thermoplastic Composites for High-Frequency Linear Arrays. *W. Huebner, M.R. Reidmeyer, J. Stevenson, L. Busse*

P1-62 Novel Processing of Ceramic/Polymer Composites Using the Dielectrophoretic Effect. *C.P. Bowen, T.R. Shrout, R.E. Newnham, C.A. Randall*

P1-63 Rochelle Salt Nanocrystals Embedded in Porous Glass. *E.K. Jang, J.W. Woo, I. Yu*

P1-64 Studies on Oriented Domain Polystyrene-TGS Composite Films. *S.C. Mathur, D.C. Dube, D.S. Rawat, H.O. Yadav, R. Kurchania, A.S. Bhalla*

P1-65 Lead Zirconate Titanate-Lead Silicate Piezoelectric Glass-Ceramics. *B. Houng, M.J. Haun*

P1-66 Characterization of $PbTiO_3$ Crystallites In-Situ Confined Grown in Amorphous Silica. *Kui Yao, Liangying Zhang, Xi Yao*

P1-67 Investigation of Domain Structure Dynamics in Gas by Atomic Force Microscopy. *A. Gruveman, O. Kolosov, J. Hatano, K. Takahashi, H. Tokumoto*

P1-68 Electronic and Ionic Trapping at Domain Walls in $BaTiO_3$. *W.L. Warren, D. Dimos, B.A. Tuttle, D.M. Smyth*

P1-69 Electric Properties and Domain Structures in $Ba(Ti,Sn)O_3$ Ceramics. *Ki-Young Oh, Kenji Uchino, L.E. Cross*

P1-70 Dynamic Observation of the Domain Configuration in Lead Magnesium Niobate and Lead Zinc Niobate Relaxor Ferroelectric Single Crystals. *M.L. Mulvihill, L.E. Cross, K. Uchino*

P1-71 Influence of Proton-Exchange Conditions on Ferroelectric Domain Inversion Caused in $LiTaO_3$ Crystals. *Ailie Tourlog, Kiyoshi Nakamura*

P1-72 HREM Studies of Ordered Superstructure in PMN and PLMN Ceramics. *Yinmei Liu, Chengyu Song, Baosong Wen*

P1-73 Controlling Chaos in Ferroelectric Systems. *R. Habel, S. Blochwitz, and H. Beige*

P1-74 Thinned Ferroelectric Crystals and Ceramics. *S. Trolier-McKinstry*

P1-75 Brillouin Scattering in Single Crystals of $Rb_{1-x}(ND_4)_xD_2AsO_4$. *C.-S. Tu, V. Hugo Schmidt*

P1-76 Raman Spectroscopy of Stoichiometric Ferroelectric Potassium Lithium Niobate. *M.J. Massey, R.S. Katiyar, B.M. Jin, A.S. Bhalla*

P1-77 Ferroelectric Transition in the Ternary System of $Pb(Mg_{1/3}Nb_{2/3})O_3$-$La(Mg_{2/3}Nb_{1/3})O_3$-$PbTiO_3$. *T.B. Wu, K.S. Liu, J.L. Chen*

-- continued on page 6

ISIF 94 PAPERS
cont.

2B-2 Preparation and Properties of Pb-Based Ferroelectric Thin Films of rf-Magnetron Sputtering. *K. Iijima, T. Takeuchi, N. Nagao, R. Takayama, and I. Ueda*

2B-3 Ferroelectric MIM and MOS Structure of Laser Deposited $(Sr0.2Ba0.8)TiO_3$ Thin Films. *H.F. Cheng and I.N. Lin*

2B-4 Micro Patterning Process of Ferroelectric Oxides by Irradiation of an Electron to Metal Naphthenate Films. *S. Okamura, A.. Kamimi, Y. Yagi, K. Mori, and T. Tsukamoto*

2B-5 Imprinting of Sputtered PZT Ferroelectric Thin Films. *J.M. Benedetto, M.L. Roush, and L.K. Lloyd*

2B-6 Analysis of the Ferroelectric Thin Films Deposited by Pulsed Laser Deposition on Oxide and Fluoride Substrates. *S. Sengupta, W.E. Kosik, J.D. Demaree, and L.C. Sengupta*

2B-7 Characterization of Sputter-Deposited (Ba,Sr) TiO_3 Thin Films on the Sidewalls of Fine-Patterned Electrodes. *S. Yamamichi, K. Takemura, T. Sakuma, H. Watanabe, H. Ono, K. Tokashiki, E. Ikawa, and Y. Miyasaka*

2C-1 Comparison of the Properties of $Pb(Zr,Ti)O_3$ Thin Films Obtained by MOCVD Using Different Kinds of Source Materials. *M. Shimizu, M. Sugiyama, H. Fujisawa, and T. Shiosaki*

2C-2 PE-MOCVD and Sol-Gel Processing of High Permittivity Dielectric Thin Films. *S.K. Dey*

2C-3 The Role of Defect Chemistry in the Electrical Properties of Ferroelectric Memory Devices. *C. Brennan*

2C-4 Barium Strontium Titanate Thin Films by Metalloorganic Solution Deposition Technique for DRAM Application. *P.C. Joshi, S.B. Krupanidhi, and A. Mansingh*

-- continued on page 6

ISIF 94 PAPERS
cont.

2C-5 Physical Vapor Deposition of Antimony Sulphoiodide (SbSi) Thin Films and Their Properties. *S. Narayanan and R.K. Pandey*

2C-6 Characteristics of NDRO Ferroelectric FETs With a Poly-Si Floating Gate. *T. Nakamura, Y. Nakao, A. Kamisawa, and H. Takasu*

2C-7 Use of Silicon Carbide Substrates in Ferroelectric Thin Film Memory Devices. *A.Y. Maksimov, A.A. Mal'tsev, and N.K. Yushin*

2C-8 Ferroelectric Thin Film Bismuth Titanate Prepared From Acetate Precursors. *Y. Lu, D. Hoelzer, W.A. Schulze, B. Tuttle, and B.G. Potter*

2C-9 Photo-CVD of $BaTiO_3$. *J. Zhang, C.P. Beetz, and S.B. Krupanidhi*

2C-10 Chemical Synthesis and Processing of Ferroelectrics Using Molecularly Modified Precursors. *P.P. Phule*

2D-1 Sol-Gel Barium Titanate Thin Films on Nickel Alloy Electrodes. *T. Ogawa, S. Saitoh, O. Sugiyama, A.. Kondoh, T. Mochizuka, and H. Mazuda*

2D-2 The Genesis of Ferroelectric Domains in Tetragonally Distorted, Chemically Prepared $Pb(Zr,Ti)O_3$ Thin Films. *B.A. Tuttle, J. Michael, J.A. Voigt, T.J. Headley, D.B. Dimos, and T.J. Garino*

2D-3 Rapid Thermal Processing of Sol-Gel Derived PZT 53/47 Thin Layers. *C.D.E. Lakeman and D.A. Payne*

2D-4 The Formation of Fine-Patterned Ferroelectric Thin Film From a Sol-Gel Solution Containing a Photo-Sensitive Water-Generator. *N. Soyama, G. Sasaki, T. Atsuki, T. Yonesawa, and K. Ogi*

2D-5 PZT-Film Compositional Development and Physical Properties. *A. Schonecker, H.J. Gesemann, S. Merklein, W. Grond, K. Franke, and M. Weihnacht*

-- continued on page 7

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 5

P1-78 Dielectric and Piezoelectric Properties of Ceramics in the Lead Indium Niobate-Lead Scandium Tantalate Solid Solution. *E.F. Alberta, A.S. Bhalla*

P1-79 An Evaluation of Lead-Zirconate Based Ceramics for Use in Non-Volatile Ferroelectric Memory Devices. *Edward F. Alberta, A.S. Bhalla*

P1-80 Ferroelectric Ceramics in the $Na_{0.5}Bi_{0.5}TiO_3$-$K_{0.5}Bi_{0.5}TiO_3$-$PbTiO_3$ and $K_{0.5}Bi_{0.5}TiO_3$-$PbTiO_3$ Systems. *O. Elkechai, J.P. Mercurio*

P1-81 Ferroelectric Properties of the Mixed Aurivillius Phase $Bi_7Ti_4NbO_{21}$. *R. Maalal, M. Manier, J.P. Mercurio, B. Frit*

P1-82 Enhanced Densification of $SrTiO_3$ Perovskite Ceramics. *Kuo-Shung Liu, I-Nan Lin*

P1-83 Phase Transition of Ferroelectric $(Na_{1/2}Bi_{1/2})TiO_3$. *S.E. Park, S.J. Chung*

P1-84 Properties of Low Temperature Sintered $Pb(Zr,Ti)O_3$ Ceramics. *R.P. Tandon, Ved Singh, N. Narayana Swami, V.K. Hans*

P1-85 A Study of Triple Sections in 4-Element Nb-Containing Systems. *R.N. Devlikanova, I.A. Gumikovsky, V.A. Otchirov*

P1-86 Microstructural Studies of Modified SBN Ceramics. *S. Narayana Murty, S. Bangar Raju, A. Bhanumathi, G. Padmavathi, K. Linga Murty*

P1-87 Frequency Response of $MgO:LiNbO_3$ Crystals. *B.M. Jin, A.S. Bhalla, I.W. Kim, B.C. Park*

P1-88 Lithium Niobate Single Crystals with Improved Sound Speed Resistance to the Light Influence. *N.I. Deriugina, M.K. Sheinkman*

P1-89 Ultrasonic and Polarization Measurements in the Mixed System $Kta_{1-x}Nb_xO_3$. *L.A. Knauss, X.M. Wang, J. Toulouse*

P1-90 Ferroelectric and Conductivity Studies on Lanthanum Modified $Ba_4Li_2Nb_{10}O_{30}$. *K. Sambasiva Rao, A.S.V. Subrahmanyam*

P1-91 Growth and Characterization of $MgO:LiNbO_3$ Crystals. *I.W. Kim, B.C. Park, B.M. Jin, A.S. Bhalla*

P1-92 Phase States in Mixed Single Crystals $K_{1-x}Li_xTaO_3$. *I.N. Geifman*

P1-93 EPR of Mn2+ in $Sn_2P_2S_6$ and $Sn_2P_2Se_6$. *I.N. Geifman, I.S. Golovina, Yu.M. Visochanski, O.A. Mikailo*

P1-94 Geometrical Phase Transitions and Their Role in the Rationalization of the Ferroceramics (Experimental Results and Imitational Computer Simulation). *A.A. Grekov, Yu.V. Dashko, L.M. Katsnelson, S.O. Kramarov, T.G. Protsenko*

P1-95 Peculiarities of the Piezooptic Effect in Incommensurate Crystals. *S.A. Sveleba, I.I. Polovinko, M.I. Bublyk, V.B. Kapustianik, V.S. Zhmurko*

P1-96 Studies on Certain Bi-Sr-Ca-Cu-O Superconductors. *V. Syamalamba, S. Narayana Murty, G. Padmavathi, K.V. Ramana Murthy, Ch.V.V. Satyanarayana*

P1-97 Pore Size Control of Porous Silica By Sol-Gel Process. *Sasa Wang, Hongling Liu, Liangying Zhang, Xi Yao*

P1-98 Preparation and Properties of Nanosized $Cd_xHg_{1-x}Te$ Crystallites Doped Glass. *Hongling Liu, Sasa Wang, Liangying Zhang, Xi Yao*

-- continued on page 7

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 6

P1-99 Measurement of the Dielectric and Piezoelectric Properties of Stacks Made from Commercially Produced PVDF, P(VDF/TeFE), P(VDF/TrFE) and Ceramic/Rubber Composite Thick Films. *Philip E. Bloomfield*

P1-100 Composition Effects on Polarization Fatigue and Leakage Currents in PZT. *D.M. Smyth, V. Saikumar, D. Dimos, R.W. Schwartz, S.J. Lockwood*

Special History Session

P2-1 Structure and Optical Properties of $PbTiO_3$-SiO_2 Nano-Composites Through Sol-Gel Process. *Qifa Zhou, Jingxiou Zhang, Liangying Zhang, Xi Yao*

P2-2 Precursor Dependent Properties of $Ba_{1-x}Sr_xTiO_3$ Thin Films Fabricated by Sol-Gel Method. *S -I. Kwan, J. Kim , J.-G.. Yoon*

P2-3 Sol-Gel Preparation of Barium Strontium Titanate Thin Films. *D. Tahan, A. Safari, L.C. Klein*

P2-4 Pulsed Laser Deposition of Ferroelectric Thin Films in Conjunction with Superconducting Oxides. *S. Sengupta, L.C. Sengupta, J.D. Demaree, W. Kosik*

P2-5 Texture of Sol-Gel Preparation of Barium Strontium Titanate Thin Films. *Donhang Liu, P. Clem, D.A. Payne*

P2-6 Preparation of Epitaxial $LiNbO_3$ Films by the Sol-Gel Method. *K. Terabe, N. Iyi, Y. Matsui, K. Kitamura, S. Kimura*

P2-7 Field-Induced Displacements in Sol-Gel Derived Ferroelectric and Antiferroelectric Thin Layers. *Jie-Fang Li, D. Viehland, T. Tani, C.D.E. Lakeman, D.A. Payne*

P2-8 Preparation and Characterization of Manganese Doped Lead Titanate Films by Sol-Gel Techniques. *R.P. Tandon, V. Raman, Ramadhar Singh, Amarjeet K. Narula*

P2-9 Preparation of Ferroelectric Film of $PbTiO_3$ by Metalloorganic Chemical Vapor Deposition. *Yan-Feng Chen, Jian-Xie Chen, Li Shun, Yu Tao, Nai-Ben Ming*

P2-10 Preferred and Aximuthal Orientations for Sol-Gel Derived PZ and PLZT Thin Layers Crystallized on Pt Electrodes. *T. Tani, D.A. Payne*

P2-11 Effect of Sol-Gel PZT Film Thickness on the Electrical Performance of Pt/PZT/Pt Capacitors. *E.A. Kneer, D.P. Birnie III, J.C. Podlesny, G. Teowee*

P2-13 Electrical Properties of PZT Thin Films Derived From Sol-Gel Solution Containing Photo-Sensitive Water-Generator. *Yuichi Nakao, Takashi Nakamura, Akira Kamisawa, Hidemi Takasu, Nobuyuki Soyama, Go Sasaki, Tsutomu Atuki, Tadashi Yonezawa, Katsumi Ogi*

P2-14 Perovskite Phase Formation in Sol-Gel Derived $Pb(Zr_xTi_{1-x})O_3$ Thin Films. *B.B. Majumdar, D.C. Agrawal, Y.N. Mohapatra, V.N. Kulkarmi*

P2-15 Sol-Gel Processed Ferroelectric Barium Titanate Thin Films and Ceramics. *H. Basantakumar Sharma, Abhai Mansingh*

P2-16 Process/Structure/Property Relations of Barium Strontium Titanate Thin Films Deposited by Multi-Ion-Beam Reactive Sputtering Technique. *C.-J. Peng, S.B. Krupanidhi*

-- continued on page 8

ISIF 94 PAPERS
cont.

2D-6 Lathanum Doped 60/40 Lead Zirconate Titanate Films by Metalloorganic Decomposition Technology. *Z.Q. Liu, W. Zhu, M. S. Tse, and H.S. Tan*

2D-7 Antiferroelectric to Ferroelectric Phase Switching Thin Films in the Lead Zirconate Stannate Titanate Solid Solution System. *C.J. Gaskey, K.R. Udayakumar, H.T. Chen, and L.E. Cross*

2E-1 Integration Issues of Ferroelectric Films. *S.B. Desu*

2E-2 Dielectric Response of Amorphous and Crystalline Ferroelectric Films. *A. Mansingh and M. Sayer*

2E-3 Switching in Ferroelectric Thin Films: How to Extract Information About Domain Kinetics From Traditional Current Data. *V.Y. Shur, E.K. Rumyantsev, S.D. Makarov, and V.V. Volegov*

2E-4 Ferroelectric Materials for Thin Film and Membrane Resonators. *A. Ballato, J.G. Gualtieri, and J.A. Kosinski*

2E-5 Design and Preparation of Sol-Gel Derived Thin Film Ferroelectric Optical Waveguides. *P.F. Baude, J.S. Wright, C. Ye, L.F. Francis, and D.L. Polla*

2E-6 Photoresponse From Ferroelectric Thin Film Capacitors: Potential Applications. *S. Thakoor*

2E-7 Novel Liquid Source CVD Technique for Ferroelectric, High Dielectric Constant and Complex Oxide Thin Films. *M. Huffman, L.D. McMillan, M.C. Scott, and C.A. Paz de Araujo*

2E-8 Development of High Permittivity Dielectric Films for Silicon Integration. *A. Pignolet*

2E-9 Antiferroelectric/Ferroelectric Composite Thin Films. *D.E. Dausch, F. Wang, and G.H. Haertling*

-- continued on page 8

ISIF 94 PAPERS
cont.

Dielectrics

3A-1 Non-Stoichiometric Doping and Transport in Ferroelectric Perovskites. *D.M. Smyth*

3A-2 A New Proposal on Mixing Rule of Dielectric Constant. *K. Wakino*

3A-4 Crack Growth in Ferroelectric Ceramics Under Mechanical and Electrical Loading. *G.A. Schneider, A. Rostek, and F. Aldinger*

3B-2 Recent Progress of Ceramic Capacitors. *Y. Sakabe*

3B-3 AC Power Handling of Ceramic Multilayer Capacitors. *J.P. Canner*

3B-4 A Model for Describing Current-Voltage Characteristics of $SrTiO_3$ Capacitors Under Low Electric Fields. *Y. Fukuda, K. Numata, K. Aoki, and A. Nishimura*

3B-5 Relating Local Electric Field in a Ferroelectric Capacitor to Externally Measurable Voltages. *F.K. Chai, J.R. Brews, R.D. Schrimpf, D.P. Birnie III, and S. Lee*

3B-6 Fine Grain Barium Titanate: Ferroelectric Domains and X-Ray Diffraction Diagram. *F. Batllo, N. Floquet, M. Maglione, M. Mesnier, J.C. Niepce, P. Perriat, and C.M. Valot*

3B-7 The Domain Mechanism of Aging and Degeneration of Ferroelectric Material. *A.S. Sidorkin*

3C-1 The Application of Microwave Ceramics. *T. Okawa, H. Utaki, and T. Takada*

3C-2 Applications of RF Dielectric Materials in Wireless Communication Equipment. *D. Anderson and M. Newell*

3C-3 Studies of Oxide Crystal Substrates for Microwave Applications of HTSC Thin Films. *R. Guo, A.S. Bhalla, R. Roy, and L.E. Cross*

3C-4 Thermostability and Dielectric Relaxation in Barium Lanthanide Titanates. *Y.M. Poplavko*

-- continued on page 9

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 7

P2-17 Study of (100) and (110) $Ba_{1-x}Sr_xTiO_3$ Expitaxial Thin Films Prepared by Laser Deposition. *N.J. Wu, H. Lin, K. Xie, X.Y. Li, A. Ignatiev*

P2-18 Peculiarities of Epitaxial $(Ba,Sr)TiO_{3/(001)}$ MgO Film Growth. *V.A. Alyoshin, E.V. Sviridov, V.P. Dudkevich*

P2-19 Processing and Characterization of Ferroelectric Thin Films in the $Pb_5Ge_3O_{11}$-$PbZr_xTi_{1-x}O_3$ System. *S.M. Landin, M.J. Haun*

P2-20 Dependence of the Piezoelectric Modulus From Type of Texture of Ferroelectric $Sn_2P_2S_8$ Films. *E.A. Amautova, N.P. Protsenko*

P2-21 Paraelectric and Mechanical Properties of PLT (28) Reactively Sputtered by Multi-Element Metal Target. *H.H. Kim, K.S. Sohn, L.M. Casas, R.L. Pfeffer, L.T. Lareau*

P2-22 Pulsed Laser Deposition and Electrical Studies of $(Pb_{1-x}La_x)TiO_3$ Thin Films for Electronic Applications. *G. Mohan Rao, S.B. Krupanidhi*

P2-23 Ferroelectric Properties of $(Pb,La)TiO_3$ Thin Films by Multiple Cathode Sputtering. *Hiroshi Maiwa, Noboru Ichinose, Kiyoshi Okazaki*

P2-24 Properties of $PbTiO_3$ Grown by Multiple Metallic Target Sputtering Method. *Robert C. Hoffman, Krishna K. Deb*

P2-25 Control of the Polarity of Stored Charge in RF Magnetron Sputtered $BaTiO_3$ Films on Silicon. *L.H. Chang, W.A. Anderson*

P2-26 Parameters of Electron Spectrum in $BaTiO_3$ Ferroelectric Thin Films. *I.V. Kityk, M.I. Kolinko, L.O. Shpaner, P. Zuh*

P2-27 Preparation of $Bi_4Ti_3O_{12}$ Thin Films by Reaction Magnetron Sputtering Using Metal Target and Their Evaluation. *T. Yamamoto, H. Matsuoka*

P2-28 RF-Sputtered $LiNbO_3$ Films for Piezoelectric Applications. *A. Bakirov, A. Margolin, L. Reznichenko, E. Sviridov, V. Dudkevich*

P2-29 Ferroelectric and Dielectric Behavior of Sol-Gel Derived Ferroelectric Oxide Thin Films on Silicon. *Debasis Roy*

P2-30 Preparation and Characterization of Sol-Gel Derived $CdTiO_3$ Films. *R.P. Tandon, Ramadhar Singh, Amarjeet K. Narula, Vandna Arora*

P2-31 Elastic Light Scattering as a Probe for Real-Time Study of the Phase Transformation Kinetics. *V. Ya Shur, S.A. Negashev, E.L. Rumyantsev, A.L. Subbotin, S.D. Makarov, E.A. Borisova*

P2-32 The Growth Behavior of Pb-Containing Perovskite Thin Films Using Pulsed Laser Deposition Technique. *I-Nan Lin, Kuo-Shung Liu, Shun-Lih Tu, Sheng-Jenn Yang*

P2-33 Dielectric, Ferroelectric, and Piezoelectric Properties of PZT Thick Films on Si Substrates. *H.D. Chen, K.R. Udayakumar, L.E. Cross, J.J. Berstein, L.C. Niles*

P2-34 Effect of Substrates on Growth and Properties of PZT Films. *Sanjay Tandon, Abhai Mansingh*

P2-35 The Structural Phase Transition in PZT Ferroelectric Films. *L.A. Sapozhnikov, I.M. Sem, I.N. Zakharchenko, E.V. Sviridov, V.A. Alyoshin,*

-- continued on page 9

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS **--** continued from page 8

V.P. Dudkevich

P2-36 The Control of the Ferroelectric Film Texture Upon RF-Sputtering. *A. Bakirov, E. Sviridov, V. Dukevich*

P2-37 Low Frequency AC Conduction and Dielectric Relaxation in PVDF Films. *Ramadhar Singh, R.P. Tandon, R.D.P. Sinha*

P2-38 Effect of Post Deposition Annealing on Sputtered Zinc Oxide Film. *Vinay Gupta, Abhai Mansingh*

P2-39 Electrical and Optical Properties of RF Sputtered Alumunium Nitride Films. *Ajay Kumar Arora, V. Anuradha, Abhai Mansingh*

P2-40 Processing and Characterization of Samarium and Manganese Modified Lead Titanate Thin Films. *C.L. Fan, W. Huebner*

P2-41 Relationships Between Thermal Treatment and Properties of PLT Thin Films. *Yun Liu, Liangying Zang, Xi Yao*

P2-42 The Structure Distortions of Ferroelectric Films Induced by Substratum. *I.N. Mochtchenko*

P2-43 Sol-Gel PZT Films for Micro-Mechanical Applications. *Keith Brooks, Nava Setter, P. Luginbuhl, G.-A. Racine, N.F. DeRooij*

P2-44 Fatigue and Retention Behaviors of Pt-PZT-Metal Capacitors with Various Top Metallizations. *G. Teowee, C.D. Baertlein, J.M. Boulton, D.R. Uhlman*

P2-45 Electrode Stress Effects on Electrical Properties of PZT Thin Film Capacitors. *Ileub Chung, I.K. Yoo, W. Lee, C.W. Chung, J.K. Lee, Seshu B. Desu*

P2-46 Breakdown in PZT Thin Film Capacitors. *I.K. Yoo, S.B. Desu*

P2-47 Pyroelectric Properties of PLT Thin Films. *W.G. Liu, Y. Liu, L.Y. Zhang, X. Yao*

P2-48 Heat Flow and Distribution of Multilayer Thin Film Pyroelectric Detector. *Q. Kang, W.G. Liu, L.Y. Zhang, X. Yao*

P2-49 Spatial Distribution of Polarization in Thin Ferroelectric Films, Peculiarities of Pyroelectric Response at High Frequencies. *E.A. Tarakanov, M. Weihnacht*

P2-50 Crystallizaton Behavior of Mod Derived PZT Thin Film. *S.B. Xiong, X.Q. Wu, L.Y. Zhang, X. Yao*

P2-51 Structural and Acoustic Properties of Sputtered Aluminum Nitride on Silicon. *F.S. Hickernell, H.M. Liaw*

P2-52 Electrical Properties of PZT Thin Films with Ir and IrO_2 Electrodes. *Takashi Nakamura, Yuichi Nakao, Akira Kamisawa, Hidemi Takasu*

-- continued on page 10

Ceramitec 94

For more information on **Ceramitec 94**, 11 - 15 October 1994 in Munich, Germany, contact the German Ceramic Society (DKG), Frankfurterstraße 196, D-51147 Köln, Germany, Phone +49-2203-69069, Fax +49-2203-69301

ISIF 94 PAPERS
cont.

3C-5 Spinel Magnesium Aluminum Titanates for Microwave Applications. *P. Kishan, C. Praksh, and A.S. Bhalla*

3C-6 Investigation of Aging Effects From Applied Continuous and Pulsed High Voltage Profiles in Ceramic Phase Shifter Materials. *S. Stowell, L.C. Sengupta, E. Ngo, M.E. O'Day, and R. Lancto*

3C-7 Studies on Dielectric Permittivity of Sol-Gel Grown Lead Titanate Films at Microwave Frequencies. *D.C. Dube, S.C. Mathur, H.O. Yadav, R. Thomas, and A.S. Bhalla*

Actuators and Electrostriction

4A-1 Compositional Study of PLZT Rainbow Ceramics for Piezo Actuators. *G. H. Haertling*

4A-2 Piezoelectric Actuators/Ultrasonic Motors—Their Developments and Markets. *Kenji Uchino*

4A-3 Fatigue Behavior of Multilayer Piezoelectric Actuators. *B. Zickgraf, G.A. Scneider, F. Aldinger*

4A-4 Piezopolymer in Active Noise Control. *S. Jolivet, A. Roure, A. Deliniere, M. Latour*

4A-5 Active Damping of Structure-Borne Pressure Waves in Aluminum Using Piezoelectric Ceramics. *M. Daglish, J. Llambias, A. Bell, M. d'Aujourd'hui*

4A-6 Choice of Electrostrictive Material. *Nikolai K. Yushin*

4A-7 Electrostriction Measurements in Diffuse Phase Transition Materials and Perovskite Glass Ceramics. *V. Sundar, R.E. Newnham, D. McCauley, K. wa Gachigi, K.A. Markowski*

4A-8 Transformation Toughening in Ferroelectric Ceramics. *C.S. Lynch, Z. Suo, R.M. McMeeking*

4A-9 "Dirty" Antiferroelectric Lead Zirconate Titanate Ceramics. *X..H. Dai, Z. Xu, D. Viehland*

-- continued on page 10

ISIF 94 PAPERS
cont.

4A-10 Field-Induced Piezoelectric Materials for High Frequency Transducer Applications. *J.T. Fielding, S.J. Jang, T.R. Shrout*

Photorefractives

5A-1 Optical Storage Using Ferroelectric Domain Switching and Thermal Fixing. *P. Gunter, R.S. Cudney, G. Montemezzani*

5A-2 Applications of Phase Conjugate Michelson Interferometer and Related Devices Using Photorefractive Crystals: A Tutorial Overview. *Aurthur E. Chiou*

5A-3 The Use of Applied Electric Fields on the Photorefractive Tungsten Bronze Ferroelectrics. *Nianyu Bei, Galen Duree, Gregory J. Salamo, Rakesh Kapoor, Edward J. Sharp, Ratnaker R. Neurgaonkar*

5A-4 Ce:Fe $LiNbO_3$ Photorefractive Crystal: Material Properties and Applications. *F.T.S. Yu, A.S. Bhalla, S. Yin, F.Zhao, Z.K. Wu, Deanna M. Salemo*

5A-5 Mutually Pumped Phase Conjugation with High Spatial Resolution. *Jan M. Yarrison-Rice, Edward J. Sharp, Gary L. Wood, Gregory J. Salamo, Richard J. Anderson, Ratnakar R. Neurgaonkar, Robert Klank*

5A-6 Large Electrooptic Modulation Using Ferroelectric Thin Films in a Fabry-Perot Etalon. *F. Wang, G.H. Haertling*

5A-7 Second Harmonic Generation (SHG) of Green, Blue, and Violet Light in $LiNbO_3$ Ferroelectric Superlattices. *Nai-Ben Ming, Ya-Lin Lu*

5A-8 Liquid Delivery CVD of PLZT Thick Films for Electro-Optic Applications. *J.F. Roeder, S.M. Bilodeau, P.C. Van Buskirk, V.H. Ozguz, J. Ma, S.H. Lee*

5A-9 Doping Effects on Photosensitivity in PZT Films. *D. Dimos, R.W. Schwartz, J.C. Barbour, W.L. Warren*

-- continued on page 11

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 9

Dielectrics

P3-1 Investigation of $Bi_{0.5}Na_{0.5}TiO_3$-$PbTiO_3$ System for High Temperature Dielectrics. *S. Kuharuangrong, W.A. Schulze*

P3-2 Supercritical Drying of Barium Titanate Alcogels. *C.D. Pethybridge, P.J. Dobson, R.J. Brook*

P3-3 Preparation and Characterization of Barium Titanate Electrolyte Capacitors from Porous Ti Bodies. *S. Venigalla, P. Bendale, J.H. Adair*

P3-4 Parametric Small Signal Amplification Near Bifurcations. *M. Diestelhorst, H. Beige, R.-P. Kapsch*

P3-5 High Field Dielectric Properties of Modified Lead Zirconate Titanate Ceramics. *K. wa Gachigi, P.M. Pruna, C.A. Randall, S.J. Jang, J.P. Dougherty*

P3-6 Pore-Dependent Dielectric Properties of Barium Titanate Ceramic. *Kyeong Ho Cho, Hee Yong Lee*

P3-7 Degradation Behavior of Ca-Doped Barium Titanate Ceramic Capacitors. *Min Huh, Kyeong Ho Cho, Hyo-Duk Nam, Hee Young Lee*

P3-8 Dielectric Breakdown in PLZT 9.5/65/35 Ceramics. *E. Furman, L.E. Cross*

P3-9 Studies on Dielectric and Ferroelectric Characteristics Exhibited by Iron-Titanium Oxygen System. *R.P. Viswanath, A.T. Seshadri*

P3-10 Coorrelation of Wetability and Interface Reaction to the Densification and Microstructural Evolution During Liquid Phase Sintering. S.*F. Wang, W. Huebner, J.P. Dougherty*

P3-11 Low-Firing Lead Magnesium Niobate Based Compositions for Thick-Film Capacitor Applications. *Y.D. Kim, M.J. Haun*

P3-12 Relationship Between Microstructure and Dielectric Properties of PZN-PFN-PFW Ternary System Capacitor. *Y.L. Tian, W.R. Xue*

P3-13 An Incommensurate-Commensurate Phase Transformation in Antiferroelectric Lead Zirconate Titanate. *Z. Xu, D. Viehland, D.A. Payne*

P3-14 Effect of Small Amount of Additives on the Formation of Pyrochlore Phase and the Stabilization of Perovskite Phase in Ceramics in PZN-PFN-PFW Ternary System. *Y.L. Tian, W.R. Xue*

P3-15 Reaction Sequence and Dielectric Properties of PFW-PFN System. *Kyung Ki Min, Nam Kyoung Kim*

P3-16 Structure-Property Relationships in Strontium Barium Niobate Relaxor Ferroelectrics. *Weng-Hsing Huang, Z. Xu, D. Viehland, R.R. Neurgaonkar*

P3-17 Dielectric Behavior of Lithium-Zinc Ferrites. *D. Ravinder*

P3-18 Dielectric Relaxations in $Pb_{0.985}La_{0.010}(Mg_{1/3}Nb_{2/3})O_3$ Ceramics. *C. Elissalde, J. Ravez, J.M. Mercurio*

P3-19 The Effect of High Temperature Annealing and Hiping on the Dielectric Properties of Modified Lead Titanate Ceramics. *M.R. Cockburn, D.A. Hall, C.E. Millar*

P3-20 Loosely Associated Ion Interaction in the Oxide and Oxyfluoride Pyrochlores. *Xiukai Cai, Liangying Zhang, Xi Yao*

-- continued on page 11

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 10

P3-21 The Structure and Dielectric Properties of New Oxyfluorides. *Xiukai Cai, Liangying Zhang, Xi Yao*

P3-22 Dielectric Properties and Low Temperature Relaxation Studies of Doped TGS Crystals. *B.M. Jin, S. Erdei, A.S. Bhalla*

P3-23 Dielectric Resistivity Studies on Rare Earth Ion Doped Ferroelectric $Ba(Cu_{1/3}Ta_{2/3})O_3$. *K. Sambasiva Rao, S.M. Mohana Rao*

3-24 Nonlinear Dielectric Properties of $KTa_{1-x}Nb_xO_3$. *R.K. Pattnaik, J. Toulouse*

P3-25 Dielectric Permittivity in Paraelectric/Ferroelectric Coexistence Region in Several Proton Glasses. *F.L. Howell, I.L. Fundaun, S. Stadler, S.C. Meschia, C.-S. Tu, V.H. Schmidt*

P3-26 Modified Ionic Polarizability Additivity Model and Its Application in Dielectric Property Studies of Ionic Materials. *Ruyan Guo, A.S. Bhalla, Rustum Roy, L.E. Cross*

P3-27 Growth of $Ba_{1-x}Sr_xTiO_3$ Single Crystals and Their Characterization. *S. Balakumar, R. Ilangovan, C. Subramanian, P. Ramasamy*

P3-28 Measurement of Ferroelectric at Microwave Frequencies and Their Performance in Microwave Devices. *W. Drach, T. Kosica, R. Babbitt, L. Sengupta, E. Ngo, S. Stowell, R. Lancto*

Microwave Dielectrics

P3MD/S-1 Microwave Dielectric Properties of $Ba(Mg_{1/3}Ta_{2/3})O_3$-$Ba(Ni_{1/3}Ta_{2/3})O_3$ System. *S.Y. Kim, H.Y. Lee, C.K. Yang, J.-J. Kim, T.-H. Kim, T.G. Choy*

P3MD/S-2 Rare-Earth Barium Antimonates: A New Class of Potential Substrates for YBCO Superconductors. *J. Koshy, J. Kurian, P.R.S. Warrier, Y.P. Yadava, A.D. Damodaran*

P3MD/S-3 Fabrication and Characterization of Barium Strontium Titanate and Nonferroelectric Oxide Composites for Use in Phased Array Antennas. *L.C. Sengupta, E. Ngo, M.E. O'Day, S. Stowell, R. Lancto*

P3MD/S-4 Study on Mixed Li-Mg-Fe Spinels for Microwave Applications. *Pran Kishan, Nitendar Kumar, Z.H. Zaidi, Chandra Prakash*

P3MD/S-5 Microwave Dielectric Properties of BaO-TiO_2-WO_3 Ceramics Sintered with Glasses. *Takahiro Takada, Sea Fue Wang, Shoko Yoshikawa, Sei-Joo Jang, Robert E. Newnham*

P3MD/S-6 Dielectric Properties of Strontium and Lead Based Complex Perovskite Ceramics. *S.A. Gridnev, N.G. Pavlova, S.P. Rogova, L.N. Korotkov, V.V. Zaentsev*

P3MD/S-7 Growth of YBCO Thin Films [Tc(O)=90K] by Pulsed Laser Ablation on Polycrystalline $GdBa_2NbO_6$, a New Cubic Perovskite Ceramic Substrate. *J. Koshy, J. Kurian, Y.P. Yadava, P.K. Sajith, A.D. Damodaran, S.P. Pai, Dhananjaya Kumar, R. Pinto, R. Vijayaraghavan*

History of Ferroelectricity

PH-1 200 Years of Research on Boracites. *A.G. Castellanos-Guzman*

PH-2 History of Electronic Ceramics In Japan. *K. Okazaki*

-- continued on page 12

ISAF 94 PAPERS
cont.

Pyroelectrics

6A-1 Uncooled Infrared Focal Plane Arrays. *Paul W. Kruse*

6A-2 Ferroelectric Ceramics and Thin Films for Uncooled Thermal Imaging Arrays. *A. Patel, P.C. Osbond, A.D. Parsons, R.C. Twiney, R.W. Whatmore, R. Watton*

6A-3 High Performance Uncooled Infrared Detector Arrays Using Thin Film Microstructures. *B. Cole, T. Horning, B. Johnson*

6A-4 Uncooled Pyroelectric Thermal Imaging. *C.M. Hanson*

6A-5 $PbTiO_3$ Thin Films for Pyroelectric Detection. *A. Bell, Y. Huang, M. Daglish, O. Paul, P. Ryser, M. Forster, N. Setter*

6A-6 The Effect of Simultaneous Organic and Inorganic Dopants on the Characteristics of Triglycine Sulface (TGS) Crystals. *R.B. Lal, S. Etminan, A.K. Batra*

6A-7 Temperature Dependent Properties of Two Perovskites Relevant to Pyroelectric Imaging. *Ahmed Amin, Benard M. Kulwicki*

6A-8 Pyrotransistor - GaAs FET with a "Pyroelectric Wafer" Gate. *Yu. M. Poplavko, V.A. Moskalyuk, V.I. Timofeyev, Yu. V. Prokopenko*

6A-9 Primary and Secondary Pyroelectric Effects in Response of Ferroelectric Radiation Detector. *V.A. Borissenok, E.Z. Novitskii*

Electrostriction/Piezoelectrics

4B/1E-1 Composite Transducers and Actuators. *R.E. Newnham*

4B/1E-3 Study on Characteristics of Standing Wave Motors. *Longtu Li, Shuxiang Dong, Zhilun Gui, Xiaowen Zhang*

4B/E-4 Mixing and Detection of Microwave Signals in Fiber-Optic Electrostrictive Sensor. *S.T. Vohra, L. Fabiny*

-- continued on page 12

ISAF 94 PAPERS
cont.

Photorefractives/Pyroelectrics/ Electrooptics

5B/6B-1 Growth, Characterization, and Application of Infrared-Sensitive Photorefractive Barium Titanate. *B.A. Wechsler, M.B. Klein, R.N. Schwartz*

ISIF 94 Proceedings to be published in *Ferroelectrics*

The first volume of the proceedings of the **6th International Symposium on Integrated Ferroelectrics**, 14 - 16 March 1994 in Monterey, California, will be published in***Ferroelectrics*** this September.

5B/6B-2 Optically Induced Ferroelectric Domain Gratings in SBN:Theory and Applications to Quasi-Phase Matching and Optical Data Storage. *Anthony S. Kewitsch, Mordechai Segev, Anmon Yariv, Gregory J. Salamo, Terry Towe, Edward J. Sharp, Ratnakar R. Neurgaonkar*

5B/6B-3 Light Induced Waveguiding and Channeling in Photorefractive Crystals. *N. Kukhtarev, H.J. Caulfield, T. Kukhtareva, Bo Su Chen*

5B/6B-4 The Design and Processing of Pyroelectric Copolymer/Silicon MOSFET Detector Arrays. *Philip E. Bloomfield*

□

ISAF 94 PRESENTATIONS

ISAF 94 POSTER SESSIONS -- continued from page 11

PH-3 Grain Sizze Effects in Barium Titanate Ceramics. *A.J. Bell*

PH-4 The History of Ferroelectric Lead Germanate $Pb_5Ge_3O_{11}$. *M.J. Haun, I.A. Cornejo*

PH-5 Joseph Valasek and His Role in the Discovery of Ferroelectricity. *Jan Fousek*

Actuators and Electrostriction

P4-1 Piezoelectric Materials Used in Antifouling Process. *M. Rahmoune, C. Tarico, M. Latour*

P4-2 PTCR Characteristics of Single Grain Boundaries with Various Growth Pattern Morphologies in Barium Titanate Ceramics. *M. Kuwabara, K. Morimo, S. Takahashi, H. Shimooka*

P4-3 A Pressure-Sensing Ceramic Device Based on PTCR Barium Titanate. *J.S. Capurso, W.A. Shulze*

P4-4 The Development of High Sensitivity NTC Thermistors. *Hiroshi Yamamoto*

P4-5 Theoretical Analysis on Traveling Wave Motor Driving Stator. *Shuxiang Dong, Longtu Li, Zhilun Gui, Xiaowen Zhang*

P4-6 A Theoretical Study of Transverse Vibrations of Thin Plates Equipped with Piezoelectric Materials. Experimental Validation. *M. Rahmoune, C. Tarico, M. Latour*

P4-7 Photo-Acoustic Devices Using PLZT-Doped Ceramics. *Sheng-Yuan Chu, Zhou Ye*

P4-8 Design of 1-3 Tubular Piezocomposite for Smart Transducer. *J. Chen, Q.M. Zhang, L.E. Cross*

P4-9 Destruction Mechanism and Destruction Detection Techniques for Multilayer Ceramic Actuators. *Hideaki Aburatani, Kenji Uchino*

P4-10 Electromechanical Properties of Rhombohedral and Tetragonal-Structured Lead Zirconate Titanate Ceramics. *Jie-Fang Li, Z. Xu, X.H. Dai, D. Viehland*

P4-11 Composite Flextensional Transducers for Sensing and Actuating. *J.F. Tressler, Q.C. Xu, S. Yoshikawa, K. Uchino, R. E. Newnham*

P4-12 Reliability of Flextensional Moonie Actuator. *A. Dogan, S. Yoshikawa, K. Uchino, R.E. Newnham*

P4-13 Electrostrictive Properties of $PbZrO_3$-$K_{0.5}Bi_{0.5}TiO_3$ Ceramics. *S.A. Gridnev, N.G. Pavlova, S.P. Rogava*

P4-14 Mechanical Impedance Characterization of Some Lead Magnesium Niobate-Lead Titanate Ceramic Stacks. *Kurt M. Rittenmyer, Rodger N. Capps, Robert Y. Ting*

P4-15 Optical Two Channel Elongation Measurement of PZT Piezoelectric Multilayer Stack Actuators. *A. Wolff, D. Cramer, H. Hellebrand, I. Probst, K. Lubitz*

P4-16 PTCR Characteristics in Undoped Barium Titanate Ceramics with Core-Shell Type Duplex Microstructures. *M. Kuwabara, E. Matsuyama, S. Takahashi, H. Shimooka, Y. Urakawa*

P4-17 Anomalous Piezoelectric Properties of Microporous Materials. *Hua Ai, Jie-Fang Li, D. Viehland*

-- continued on page 13

ISAF 94 POSTER SESSIONS

ISAF 94 POSTER SESSIONS -- continued from page12

P4-18 The Role of Statistical Design in the Development of Electrostrictive Materials. *S.E. Prasad, S. Varma, T. Hoang, A. Ahmad, T.A. Wheat*
P4-19 High-Power Characteristics of Piezoelectric Materials. *Seiji Hirose, Sadayuki Takahashi, Manabu Aoyagi, Yoshiro Tomikawa*

Photorefractives
P5-1 Photorefractive Properties of Cr/Mo Co-Doped SBN:60. *Gary L. Wood, Brian P. Ketchel, R.R. Neurgaonkar*
P5-2 Flux Growth of Bulk Photorefractive Barium Titanate Crystals. *M.D. Aggarwal, W.S. Wang, J. Choi*
P5-3 Growth and Properties of Tungsten-Bronze Ferroelectric Potassium Lithium Niobate Single Crystals for Optical Applications. *M. Adachi, Z. Chen, A. Kawaba*
P5-4 Diffusion-Stimulated Domain Inversion in $LiNbO_3$ Crystals. *V.D. Kugel, G. Rosenmann*
P5-5 A New Example for Memory Effects in Modulated Systems: Optical Activity of Incommensurate Crystals. *O.S. Kushnir, O.G. Vlokh*
P5-6 Anisotropy of Speckle-Field in Barium-Sodium Niobate Crystals. *S.V. Ivanova, I.I. Naumova*
P5-7 Spectral-Temperature Transformations of Optical Indicatrices in RS, DRS, ARS Crystals for Double-Axes to Single-Axes and Their Possible Use in Temperature Applications. *V.M. Gava, M.O. Romanyuk*
P5-8 Effects of Stress on the Electrooptic Properties of PLZT Thin Films. *William E. Paradise, F. Wang, G.H. Haertling*
P5-9 Growth and Device Fabrication of KDP and DKDP Crystals. *G. Ravi, K. Srinivasan, S. Anbukumar, P. Ramasamy*
P5-10 Electrooptic Switching Behavior of a Novel Short Pitch Ferroelectric Liquid Crystal Mixture. *K.K. Raina, H.J. Coles*
P5-11 Hyperpolarizabilities and Dipole Moment Calculations for Various Nitroaline Molecules and the Effect of Methyl Group Orientation. *S.C. Mathur, D.C. Dube, D.P. Tewari, B.V.V.S.N. Prabhakara Rao, A.S. Bhalla*
P5-12 Photorefraction in $Sn_2P_2S_6$ Ferroelectrics. *A.A. Grabar, Yu.M. Vysochanskii*
P5-13 Temperature Dependent Electrooptic Properties of Lead Barium Niobate Single Crystals. *Ruyan Guo, J.F. Wang, J.M. Povoa, A.S. Bhalla*
P5-14 Nonlinear Optical Properties of Sol-Gel Derived Silica Nanocomposites Doped with Semiconducting Sulfide Microcrystallines. *Quingchun Zhao, Chunliang Liu, Hongling Liu, Liangying Zhang, Xi Yao*
P5-15 Study of Colloidal Stability and Electrooptical Properties of Anisotropic, Nanosize Metal and Semiconductor Particles in the Presence of Electric Field. *T. Li, T. Kido, J.H. Adair*
P5-16 Surface Modification Investigation of Lithium Niobate Single Crystal Fiber. *W.X. Que, X. Yao, Y.J. Huo*
P5-17 Optical Properties of Potassium Niobate Thin Film Waveguides. *Alice Chow*

Pyroelectrics
P6-1 Surface Layers of TGS Class Ferroelectrics and $Sn_2P_2S_6$ and SbSI Ferroelectrics-Semiconductors in the Phase Transition Region. *O.V. Malyshikina, A.A. Bogomolov, M.M. Major*
P6-2 Pyroelectric Characteristics of Ferroelectric $Sn_2P_2S_6$ Films. *E.A. Amautova, E.D. Rogach, N.A. Kosonogov*
P6-3 Influence of Irradiation on the Thermochromic Phase Transition in Diethlamminetetrachlorcuprate. *V.B. Kapustianik, Ya. V. Ozhybko, S.A. Sveleba, R.T. Tchukvinskyi, V.I. Soldatov, I.I. Polovinko*
P6-4 Fabrication of Pyroelectric Thin Film Ceramics by Tape Casting Method. *R.B. Liu, S.W. Lin, C.F. Qu, C.H. Yao, Y.H. Jin, S.R. Zhang, C.W. Zhong*
P6-5 Dielectric Studies on Amino Acid Mixed TGS Crystals. *G. Ravi, S. Aravazhi, G. Arunmozhi, S. Anbukumar, P. Ramasamy*
P6-6 Ferroelectric Studies on Pure and Doped TGS Type Crystals. *G. Arumnozhi, S. Aravazhi, G. Ravi, S. Anbukumar, P. Ramasamy*
P6-7 Growth of KTN Single Crystals by Step Cooling Technique and its Dielectric Constant Study. *R. Ilangovan, S. Balakumar, C. Subramanian, P. Ramasamy*
P6-8 Nonlinear Pyroelectric Phenomena in Deuterated TGS. *A.A. Bogomolov, T.A. Dabizha, O.V. Malyshkina*
P6-9 Dielectric, Piezoelectric and Pyroelectric Properties of Barium-Modified Lead Magnesium Tantalate-Lead Titanate Ceramics. *S.W. Choi and J.M. Jung*

-- continued on page 14

ISAF 94 POSTER SESSIONS

ISAF 94 POSTER SESSIONS -- continued from page 13

P6-10 Dielectric, Piezoelectric and Pyroelectric Properties of the $Pb(Mg_{1/3}Ta_{2/3})O_3$-$PtTiO_3$-$PbZrO_3$ Solid Solution System. *H.Y. Weon, Y.J. Kim, S.W. Choi*

P6-11 Dielectric, Piezoelectric and Pyroelectric Properties of Sr-Doped $Pb(Mg_{1/3}Ta_{2/3})O_3$-$PtTiO_3$-$PbZrO_3$ Solid Solution Ceramics. *J.M. Jung, Y.H. Park, S.W. Choi*

P6-12 Prospects for One-Crystal Infrared and Acoustic Imaging Devices. *Y.M. Poplavko*

P6-13 Series Pyroelectric Ceramics Used for Small Area IR Detector. *R.B. Liu, S.W. Lin, C.F. Qu, C.H. Yao, Y.H. Jin, Y.S. Lin, Y.R. Zhang*

P6-14 Induced Phase Transition in Functional Ceramics and Their Applications. *Y.L. Wang,R.B. Liu*

P6-15 Pyroelectric Ceramics with Low Resistivity. *R.B. Liu, S.W. Lin, C.F. Qu, C.H. Yao, Y.H. Jin*

P6-16 Pyroelectric and Dielectric Properties of Dry and Moist TGS-Gelatin Films. *Vadim Khutorsky, Sidney B. Lang*

P6-17 Pyroelectricity in Nylon 11 and Nylon 7 Ferroelectric Polymers. *S. Esayan, S.L. Wur, J.I. Scheinbeim, B.A. Newman*

P6-18 Properties of New ATGS-PVDF Ferroelectric Composite Film. *Changshui Fang, Qingwu Wang, Hongshen Zhuo, Min Wang, Peilin Zhang*

P6-19 Growth and Properties of TGS:Cr6+ Crystal. *Changshui Fang, Hong Liu, Qingwu Wang, Hongsheng Zhuo, Min Wang, Dong Xu*

P6-20 Pyroelectric Receivers, Frequency Sensitivity for Modulated IR-Stream. *Y.K. Yatsenko*

P6-21 Inhomogeneity Study of Doped TGS Crystals Using Micro-Probe Raman Spectroscopy. *B.M. Jin, S. Erdei, A.S. Bhalla*

P6-22 Pyroelectric Measurements on Various Kinds of Doped TGS Crystals. *B.M. Jin, S. Erdei, A.S. Bhalla*

P6-23 Electroelastic and Pyroelectric Effects in the Microinhomogeneous Medium of the Piezoceramics/Metal Type. *A.A. Kuprienko, A.A. Grekov. S.O. Kramarov*

P6-24 New Possibilities of Spontaneous Polarization Reorientations in Ferroelectric Crystals. *E.F. Dudnik, V.M. Duda* □

Electroceramics IV

In the *Ferroelectricity Newsletter*, Vol. 1, No. 4, p. 9 we gave details about the 4th International Conference on Electronic Ceramics & Applications, from **5 - 7 September 1994** in **Aachen, Germany,** held under the auspices of the European Ceramic Society. Here is some more information:

In addition to invited and a selection of contributed lectures, the conference features a comprehensive poster session.

Sessions and Presenters of Invited Lectures

- Dielectrics and Microwave Materia;ls -- *J.-C. Niepce and T. Negas**
- Ferroelectrics, Piezoelectrics, Relaxors -- *D. Damjanovic, A. Kingon, P. Osbourne, and K. Uchino*
- Grain Boundary Controlled Materials -- *P. Abelard and E. Olsson*
- Electronic and Ionic Conductors -- *A. Feltz and B.C.H. Steele*
- Superconductors -- *J. Maier* and B. Raveau*
- Substrates and Integrated Functions -- *A. Okamoto, R.R. Tummala, and W. de Wild*
- Magnetics -- *P. Görnert and J. Pankert*
- Processing and Mechanical Properties -- *M. Klee and G. de With*

** to be confirmed*

Sponsors

Deutsche Keramische Gesellschaft (DKG); RWTH Aachen University of Technology; Werkstoff-Forum der RWTH Aachen; aachen congress service; La Société des Electriciens et des Electroniciens

Proceedings

The conference proceedings will be provided to participants at registration. A selection of papers will be published in *Silicates Industriels - Ceramic Science and Technology* in an extended version.

CONFERENCE REPORTS

41ST SPRING MEETING OF THE JAPAN SOCIETY OF APPLIED PHYSICS

General Observations

Meetings of the Japan Society of Applied Physics are held twice a year, in spring and autumn. The spring meeting is usually held in the Kanto area (greater Tokyo area), and the autumn meeting in another location in Japan. The 41st Spring Meeting of the Japan Society ofApplied Physics (Oyo Butsuri Gakkai) was held in Meiji University, Kawasaki City, south of Tokyo, from 28 to 31 March 1994. Divided into 15 sessions, the conference attracted approximately 10,000 to 15,000 participants and there were more than 4,000 presentations. The thin film session comprised 177 presentations and was divided into two small sessions. There were 75 presentations in the session devoted to high permittivity materials and related topics, and depending on the day, the attendance varied between 150 and 200 researchers. With participation of roughly 50 percent university and national research laboratory and 50 percent industry attendees, the Oyo Butsuri Gakkai is an excellent forum for the exchange of ideas between researchers belonging to the Japanese ferroelectric research community. Spring meetings of the Oyo Butsuri Gakkai held near Tokyo usually attract more scientists from the Kansai area (Kyoto-Osaka-Kobe) than from the Kanto area, and this year again, a majority of the presentations were from Kansai universities (e.g., Osaka University, Kyoto University) and companies (e.g., Mitsubishi, Matsushita, Sharp, Rohm).

Presentations at the Oyo Butsuri Gakkai last 15 minutes, including questions. A booklet of abstracts is provided on the first day of the conference, but extended papers are not published afterwards. This spring, about 50 percent of the presentations were related to Pb-based titanates, 30 percent to Ba and Sr-based titanates, and the remaining 20 percent to other materials ($Bi_4Ti_3O_{12}$, $BaMgF_4$, $LiNbO_3$). Totaling 40 percent of the presentations, the MOCVD technique has become the most studied preparation method, well ahead of sputtering (20 percent), sol-gel (20 percent) and pulsed laser deposition (10 percent).

Main Features

The main features of this Spring Oyo Butsuri Gakkai were:

•The growing interest for MFIS and MFMIS structures, with presentations by the Tokyo Institute of Technology (28a-MF-4), Olympus (28p-MF-13) and Rohm (30p-ME-7, 30p-ME-8). Problems such as damage of the gate dielectric and difficult ferroelectric-silicon interface control, encountered for the simpler MFS structure, should be overcome by forming MFIS or MFMIS structures, which still allow the vertical integration of a capacitor on top of an FET transistor.

•The large number of papers related to multilayers of various ferroelectric materials, with reports on $PbTiO_3$/$PbZrO_3$ multilayers by Matsushita (28p-MF-1) and Osaka University (28p-MF-2), on $(BaTiO_3)_m$-$(SrTiO_3)_n$ and $SrTiO_3$/$BaTiO_3$ superlattices by Osaka University (28p-MF-3) and Kawasaki Heavy Industries (28p-MF-4), respectively, on (Sr,(Nb,Ti)O_3/$SrTiO_3$ superlattices by the Tokyo Institute of Technology (28p-MF-5), on TiO_2/PbO multilayers by Osaka University (28p-MF-9), and on a PZT/PT/PLT/PT structure by Rohm and Mitsubishi Materials (30p-ME-7). With the increasing use of $PbTiO_3$ template layers in PZT-based capacitors, interest has grown for multilayered materials, expected to alleviate some of the problems encountered in DRAM and NVRAM capacitors while keeping the required ferroelectric or paraelectric properties.

•The increasing use of alternate annealing techniques (e.g., RTA, laser, UV-O_3) after ferroelectric thin film preparation, in order to avoid detrimental interdiffusion at the ferroelectric/electrode interfaces by reducing the thermal budget, while allowing an improvement of the ferroelectric thin film properties (higher permittivity, lower leakage currents). Osaka University thus reported the laser annealing of $SrTiO_3$ thin films prepared on YBCO/MgO (28p-MF-7), Fujitsu reported the UV -O_3 annealing at 200°C of sputtered $SrTiO_3$ films (29a-ME-8) and Hitachi, Oki, and Fuji-Xerox reported the RTA annealing of reactively evaporated (29a-ME-1), DC and RF sputtered (30a-ME-4) and sol-gel prepared (30p-ME-3) PZT thin films, respectively. Sharp reported the RTA annealing below 650°C of sol-gel $Bi_4Ti_3O_{12}$ films prepared on Pt/Ti/SiO_2 (28a-MF-10).

•The large number of presentations reporting the influence of bottom structures (electrode or template layer) on the properties of ferroelectric thin films. The film properties found to depend on the underlying structure are the

-- continued on page 16

CONFERENCE REPORTS

41ST SPRING MEETING OF THE JAPAN SOCIETY OF APPLIED PHYSICS -- continued from page 15

crystallinity, microstructure, dielectric constant, leakage current, hysteresis loop. The Tokyo Institute of Technology reported that the crystallinity of the bottom platinum, measured by X-ray diffraction (FWHM, rocking curve), strongly affects the crystallinity of $BaMgF_4$ thin films grown by MBE at 500°C (28a-MF-4). Kyoto University measured a higher permittivity for MOCVD $Bi_4Ti_3O_{12}$ films on Pt/Ti than on Pt (28a-MF-9). Matsushita also reported a higher permittivity of ε_r = 420 for sputtered PZT films on Pt/Ti/SiO_2/Si than on Pt/MgO (ε_r= 380) (28p-MF-1). Kyoto University reported a change in the microstructure of MOCVD PZT films on Pt(111)/SiO_2/Si when an initial $PbTiO_3$ template layer is grown before PZT deposition (28p-MF-10). The research institute RITE and Matsushita reported the influence of a buffer layer on the lattice spacing of PLZT films grown by DC sputtering on sapphire (28p-MF-11). Kyoto University showed that the crystallinity of Pt(111) in a Pt/SiO_2/Si structure strongly affects the crystallinity of MOCVD PZT and its leakage current (29a-ME-2). The lowest leakage current levels were obtained for PZT films deposited on Pt with the best crystallinity (lowest FWHM). Chubu University presented the influence of the RuO_2 electrode thickness on the dielectric constant, microstructure and hysteretic properties of MOCVD PLZT films used in a PLZT/RuO_2/Si structure (29a-ME-4). Fujitsu reported a decrease in the leakage current of RF sputtered $SrTiO_3$ films when the bottom Pt electrode is sputtered using an Ar + O_2 mixture instead of simply Ar (29a-ME-9). Rohm reported that sol-gel Pb-based multilayers exhibit a higher P_r and reduced fatigue when grown on Pt/IrO_2 (30p-ME-7).

•The increasing effort made by chemical companies to find new MOCVD source materials, which have high vapor pressures at low temperatures and do not decompose at the vaporization temperature. Tri Chemical Lab. (29p-ME-2) and Kyoto University (29p-ME-15) reported the preparation of PZT thin films by MOCVD using TEPOL or $(C_2H_5)_3PbOCH_2C(CH_3)_3$ as the Pb source materials. Dowa Mining reported the preparation of MOCVD BaO using $Ba(Me_5C_5)_2$-THF_2 or bis-pentamethylcyclopentadienyl-barium diluted in tetrahydrofuran (29p-ME-3). Tri Chemical Lab. (29p-ME-4) and Fujitsu (29p-ME-5) finally reported the preparation of $SrTiO_3$ films by MOCVD using powder $Sr(DPM)_2$ diluted in various solvents.

•The measurement by a team of Texas Instruments Japan of significant levels of a particle emission from platinum in a Pt/Ti/SiO_2/Si structure (28p-MF-14). The emission of 0.0085 particle α/cm^2/h measured for Pt containing 0.01 percent Pt^{190} could be very detrimental to DRAM operation.

Other Interesting Points

In what follows, more information is given concerning several interesting presentations that have not been mentioned or detailed in the previous part.

•The Science University of Tokyo reported the preparation of polycrystalline $BaMgF_4$ thin films on $TiSi_2$ by vacuum evaporation at 400 - 750°C, followed by an annealing step performed at 900°C foor 30 min in vacuum (10^{-3} Torr) (28a-MF-5).

•Kawasaki Heavy Industries and Osaka University showed that $SrTiO_3$/$BaTiO_3$ superlattices can have very different properties depending on the number of $BaTiO_3$ and $SrTiO_3$ consecutive units (28p-MF-4). The number of units was measured in situ by RHEED. 25-unit $SrTiO_3$/$BaTiO_3$ multilayered films exhibit a permittivity very close to that of $(Ba,Sr)TiO_3$ films, whereas 2- or 4-unit $SrTiO_3$/$BaTiO_3$ multilayered films have a higher dielectric constant but also a larger frequency dependence for ε_r.

•Hitachi reported the preparation of PZT thin films on Pt/SiO_2/Si by reactive evaporation in O_3 at room temperature or below and 2~5 10^{-7} Torr (29a-ME-1). After an RTA annealing treatment at 700°C for 60 s, 1500 Å films (Pb/Zr+Ti)=1.0) exhibited a dielectric constant ε_r = 840 and a leakage current density of $2x10^{-7}A/cm^2$ at 3.0 V.

•Chubu University presented results concerning the preparation of PLZT thin films on Pt/RuO_2/Ta_2O_5/Si by MOCVD (29a-ME-4). A very sharp interface was reported between RuO_2 and Ta_2O_5.

•Sharp investigated various Ta-based barrier layers in PZT/Pt/Ta-barrier/Si structures for application to FRAMs (29a-ME-5). TaN_x was shown to efficiently act as a barrier for annealing treatments up to 500°C for 30 min in N_2/O_2.

-- continued on page 17

CONFERENCE REPORTS

41ST SPRING MEETING OF THE JAPAN SOCIETY OF APPLIED PHYSICS -- continued from page 16

•Texas Instruments Japan reported the influence of growth and annealing temperatures on the microstructure and leakage current of $(Ba,Sr)TiO_3$ thin films prepared by laser ablation (29a-Me-6). As-deposited crystallized films had a columnar structure and a permittivity ε_r = 350, whereas films crystallized by post deposition annealing had a granular structure and ε_r = 250~280. However, lower leakage currents were obtained for post-deposition annealed films than for as-deposited crystalline films.

•Fujitsu announced that the same improvement in properties could be obtained for RF magnetron sputtered $SrTiO_3$ films by annealing in UV-O_3 at 200°C and in O_2 at 400°C (29a-ME-8). The UV-O_3 annealing is more interesting though, because it is a low temperature process.

•Fujitsu also reported that RuO_2(1000Å)/Ru(500Å)/Si and $SrTiO_3$(1500Å)/RuO_2(500Å)/Ru(500Å)/Si structures can withstand annealing at 600°C in air without degradation (29a-ME-11). The RuO_2 and Ru films were deposited by sputtering at 450°C.

•Tri Chemical Lab. (29p-ME-2) and Kyoto University (29p-ME-15) reported the preparation of PZT thin films by MOCVD using TEPOL as the Pb source materials. TEPOL starts decomposing between 130 and 190°C and was thus heated at a temperature close to 85°C.

•Dowa Mining reported the preparation of MOCVD BaO using $Ba(Me_5C_5)_2$-THF_2(29p-ME-3). The material heated at 150°C was stable for more than 200 hours.

•Tri Chemical Lab. (29p-ME-4) and Fujitsu (29p-ME-5) reported the preparation of $SrTiO_3$ films by MOCVD using powder $Sr(DPM)_2$ diluted in various solvents. $Sr(DPM)_2$-trien was heated at 120˚C and $Sr(DPM)_2$-tetraen was heated at 130°C. 800 Å $SrTiO_3$ films prepared on Pt/SiO_2 by MOCVD at 560 °C, using these sources, exhibited leakage current densities at the 10^{-7} A/cm^2 level and dielectric constants were ε_r=190 (tetraen) and ε_r=215 (trien).

•Osaka Gas reported the low temperature preparation of MOCVD PZT films on Pt/(111)SiO_2/Si(100) (29p-ME-10). Perovskite PZT was obtained for substrates temperatures in 340-420°C range, but films were leaky. Films prepared at 500°C exhibited a leakage current density of 10^{-7} A/cm^2.

•Kyoto University showed that lower leakage currents were obtained for films prepared at 625°C by O_3 photo MOCVD than by O_3 thermal MOCVD and O_2 thermal MOCVD (29p-ME-14).

•Osaka Gas (29p-ME-12) and the Japan Energy Corporation (29p-ME-13, 29p-ME-14) reported the preparation of PZT thin films by laser-CVD. PZT films could be prepared at low temperatures (200-400°C) with reasonable deposition rates (17-30) Å/min), but were reported either to be amorphous (29p-ME-12) or to contain about 10 percent carbon (9p-ME-13), making post deposition annealing necessary.

•Mitsubishi Electric reported the preparation of $(Ba,Sr)TiO_3$ thin films by MOCVD on $Pt/SiO_2/Si$ for DRAM application (29p-ME-17, 29p-ME-18). $Ti(i\text{-}OC_3H_7)_4$, O_2/N_2O and $Ba(DPM)_2$ and $Sr(DPM)_2$ diluted in THF and were used as source materials. BST films prepared at 550°C with (Ba+Sr)/Ti = 1.01 exhibited a leakage current density of 2.4x10^{-6} A/cm^2, tan ∂ = 0.07 and t_{eq} = 0.52 nm.

•Results concering the preparation of PZT thin films by reactive sputtering were presented by the National Defense Academy (30a-ME-3). The existence of the pyrochlore phase and oriented and nonoriented perovskite phase were shown to depend on the substrate temperature and sputtering gas pressure. Perovskite only is formed for T ≥ 500°C, and (111) single oriented PZT could be formed on Pt(111)/Ti(010)/SiO_2/Si at T = 550°C and P = 5 Pa.

•The Tokyo Institute of Technology reported the epitaxial growth by MBE of $SrTiO_3$(100) films on Si(100) with SrF_2 or CaF_2 buffer layers (30a-ME-8).

•Sumitomo Electric reported the preparation of $SrTiO_3$ thin films by reactive coevaporation in O_3 on YBCO and conductive 0.5 percent Nb-doped $SrTiO_3$ at 300-630°C (30a-ME-8).

•Oki Electric showed the influence of the substrate conditions (floating vs. grounded) on the dielectric constant of $SrTiO_3$ films prepared by reactive sputtering in O_2 at 300°C (30a-ME-10). A maximum permittivity ε_r = 375 was obtained for 300 Å films when the substrate was floated during sputtering t_{eq} = 0.68 nm is believed to be the lowest value reported to date for $SrTiO_3$ thin films on $Pt/SiO_2/Si$, but leakage current density at 1.5 V was in the 10^{-5}

-- continued on page 18

CONFERENCE REPORTS

A/cm^2 range.

41ST SPRING MEETING OF THE JAPAN SOCIETY OF APPLIED PHYSICS -- continued from page 17

•Fuji Xerox showed that perovskite PZT (001) could be formed on $SrTiO_3$ (100) by sol-gel deposition and RTA anneal at 425°C, whereas an RTA anneal at 600°C was necessary on MgO(100)(30-ME-3).

•Oki Electric reported that sol-gel prepared PZT/$PbTiO_3$ multilayers have a lower dielectric constant and remanent polarization than simple PZT on platinum, but also exhibit lower leakage currents and better fatigue (30p-ME-4).

•Rohm finally reported that sol-gel prepared PZT/PT/PLT/PT multilayers have a higher Pr and reduced fatigue compared to PT/PZT/PT multilayers grown on Pt/IrO_2 (30p-ME-7).

Pierre-Yves LESAICHERRE
ULSI Device Development Laboratories
NEC Corporation
1120 Shimokuzawa, Sagamihara
Kanagawa 229, Japan

PAPERS PRESENTED AT OYO BUTSURI GAKKAI -- SPRING 1994 MEETING

28a-MF-1	The formation of Ti Oxide by low temperature annealing treatment in O_2	Osaka Sangyo University
28a-MF-2	Electrical properties of tantalum anodic oxide film	Nihon University, Hitachi AIC
28a-MF-3	Electrical properties of ferroelectric $BaMgF_4$/Si structures	Tokyo Institute of Technology
28a-MF-4	Preparation of (120) orientated ferroelectric $BaMgF_4$ films on Pt/Ti/SiO_2/Si (100)	Tokyo Institute of Technology
28a-MF-5	Fabrication of $BaMgF_4$ thin films on titanium silicide electrodes by vacuum evaporation	Science University Tokyo
28a-MF-6	Preparation of $KNbO_3$ films by RF magnetron sputtering	Yamamura Glass
28a-MF-7	Preparation of $LiNbO_3$ thin films by the low-pressure MOCVD method	Shizuoka University
28a-MF-8	Preparation of $LiNbO_3$ films by the sol-gel method	NIRIM
28a-MF-9	Growth and properties of $Bi_4Ti_3O_{12}$ thin films by MOCVD	Kyoto University, Rohm
28a-MF-10	Preparation of $Bi_4Ti_3O_{12}$ thin films by the sol-gel method	Sharp
28p-MF-1	Preparation of Pb-based ferroelectric thin films by multi-ion beam sputtering (IV)	Matsushita Electric
28p-MF-2	Preparation of $PbZrO_3$/$PbTiO_3$ multilayers by the laser ablation technique	Tokyo Institute of Technology
28p-MF-3	Fabrication and characterization of $(BaTiO_3)_m$-$(SrTiO_3)_n$ superlattice (II) Thin film growth by Eclipse PLD and evaluation of interfaces	Osaka University
28p-MF-4	Dielectric properties of the $SrTiO_3$/$BaTiO_3$ superlattices formed with atomic/molecular order control	Kawasaki Heavy Industries, Osaka University
28p-MF-5	Preparation of (Sr(Nb,Ti)O_3/$SrTiO_3$) superlattice by laser MBE	Tokyo Institute of Technology
28p-MF-6	Fabrication and characterization of $Ba_xSr_{1-x}TiO_3$ thin films grown by ArF excimer laser ablation	Osaka University
28p-MF-7	Effect of excimer laser anneal on $SrTiO_3$ thin films	Osaka University
28p-MF-8	Molecular dynamics simulation of the dielectric properties of (Ba,Sr)TiO_3	Osaka Univ., Kawasaki Heavy Indust.
28p-MF-9	Preparation of $PbTiO_3$ thin films by the laser ablation method	Osaka University
28p-MF-10	AFM observation of the $PbTiO_3$ initial layer in a two step PZT growth process	Kyoto University
28p-MF-11	Microstructure of sputtered PLZT thin films	RITE, Matsushita Electric
28p-MF-12	Hysteretic leak current through epitaxial ferroelectric thin films	Kanazawa University, Murata Manufacturing
28p-MF-13	A feasibility study of nondestructive readout of a ferroelectric memory device	Olympus Optical
28p-MF-14	Alpha particle emission from platinum and its interface influence on DRAM operation	Texas Instruments Japan
28p-MF-15	Consideration on adaptive learning effect of PZT (2)	Tokyo Institute of Technology
29a-ME-1	Preparation of PZT thin films by reactive evaporation	Hitachi
29a-ME-2	Effect of crystallinity of Pt electrode on the leakage characteristics of PZT thin films	Kyoto University
29a-ME-3	Application to DRAM capacitor of PLZT thin films by MOCVD	Chubu University
29a-ME-4	Properties of PLZT/RuO_2/Si structure prepared by MOCVD	Chubu University
29a-ME-5	Ta-based diffusion barriers for MOCVD PZT capacitor	Sharp

-- continued on page 19

CONFERENCE REPORTS

PAPERS PRESENTED AT OYO BUTSURI GAKKAI -- SPRING 1994 MEETING

--continued from page 18

29a-ME-6	Reduction of leakage currents by controlling grain structures of high dielectric constant (Ba,Sr)TiO_3 thin films	Texas Instruments Japan
29a-ME-7	Analysis of current-voltage characteristics of $SrTiO_3$ capacitors	Texas Instruments Japan
29a-ME-8	O_2 plasma irradiation effect on $SrTiO_3$ films	Fujitsu
29a-ME-9	Influence of metal deposition on the leakage current of $SrTiO_3$ capacitors	Toshiba
29a-ME-10	Dielectric properties of $(Ba_xSr_{1-x})TiO_3$ thin films prepared by sputtering	Matsushita Electric
29a-ME-11	RuO_2 thin films as an oxygen barrier layer	Fujitsu
29p-ME-1	Investigation of the vapor phase reaction of Ta_2O_5 CVD using the ab initio MO method	Nissan Motor, Tokyo Univ. Agri. & Tech., Waseda Univ.
29p-ME-2	Properties of a new Pb precursor for use in MOCVD	Tri Chemical, Kyoto Univ., St. Mariana Univ. Medicine
29p-ME-3	Properties of a novel barium compound for MOCVD	Dowa Mining
29p-ME-4	Research of low temperature vaporization and liquid source $Sr(DPM)_2$ adducts	Tri Chemical, Fujitsu
29p-ME-5	Preparation of $SrTiO_3$ thin films by CVD using a novel Sr source	Fujitsu, Tri Chemical
29p-ME-6	Preliminary study on the atomic layer epitaxy of ferroelectric thin films (1)	Tokyo Univ. Agri. & Tech., Nissan Motor, Waseda Univ.
29p-ME-7	Preparation of oriented PZT film by the digital CVD method with a reduction in vapor phase reactions	Waseda Univ., Tokyo Univ. Agri. & Tech., Asahi Chem. Indust.
29p-ME-8	Low temperature preparation of PZT thin films by digital CVD	Tokyo U. Agri. & Tech., Nissan Mot., Waseda U.
29p-ME-9	Low temperature deposition of $SrTiO_3$ thin films by ECR-CVD	NEC
29p-ME-10	An investigation of PZT thin films deposited by low temperature MOCVD	Osaka Gas, Kansai Research Institute
29p-ME-11	Growth of PZT thin films by photo MOCVD using O_3 (II)	Kyoto University
29p-ME-12	Preparation of PZT thin films by the laser-CVD method	Osaka Gas, Kansai Research Institute
29p-ME-13	Fabrication of PZT thin films by the laser-MOCVD method (I)	Japan Energy Corporation
29p-ME-14	Fabrication of PZT thin films by the laser-CVD method (II)	Japan Energy Corporation
29p-ME-15	Large area growth of PZT and PLZT thin films by MOCVD	Kyoto University, Amaya
29p-ME-16	Highly uniform $Pb(Zr,Ti)O_3$ thin films fabricated by MOCVD	Hitachi
29p-ME-17	Preparation of (Ba,Sr)TiO_3 thin films by CVD using liquid sources (I)	Mitsubishi Electric, Kita-Itami Works
29p-ME-18	Preparation of (Ba,Sr)TiO_3 thin films by CVD using liquid sources (II) —Dielectric properties	Mitsubishi Electric, Kita-Itami Works
30a-ME-1	PbO thin films prepared by reactive magnetron sputtering	Numazu College of Technology
30a-ME-2	Preparation of (Pb,La)TiO_3 thin films bymultiple cathode sputtering (II)	Shonan Inst. of Tech., Waseda Univ.
30a-ME-3	Preparation of PZT thin films by reactive sputtering using metals and their evaluation	Nat.Defense Acad., Kyoto U.
30a-ME-4	Control of the Pb composition in the depth in sputtered PZT and the electrical properties	Oki Electric
30a-ME-5	Effect of the electrode materials on PZT film deposition by laser ablation	Kanazawa Univ., Ishikawa Ind. Res. Inst.
30a-ME-6	Preparation of Pb(Zr,Ti)O3 thin films by dual-source evaporation (II)	Tokyo Inst. of Technology
30a-ME-7	Role of fluoride buffer layers in the epitaxial growth of $SrTiO_3$ films on Si(100) substrates	Tokyo Inst.of Technol.
30a-ME-8	SrTiO3 thin films fabricated bythe reactive coevaporation method	Sumitomo Electric Industries
30a-ME-9	Grain growth and interfacial reactions in $SrTiO_3$ layers	Hosei University, Oki Electric Industry
30a-ME-10	Dependence of sputtered $SrTiO_3$ film characteristics on the substrate condition	Oki Electric Industry
30p-ME-1	Interaction of CVD ferroelectric films with the Si Substrate (II)	Nissan Arc, Nissan Motor, Asahi Chem. Ind. Tokyo Univ. Agri. & Tech., Waseda Univ.
30p-ME-2	Preparation of $PbTiO_3$ film by the screen printing method	Toyama Industrial Technology Center
30p-ME-3	Preparation and characterization of sol-gel derived epitaxial PZT thin films	Fuji Xerox
30p-ME-4	Characteristics of sol-gel derived PZT/PTO multi layers	Oki Electric Industry
30p-ME-5	P-E characteristics of 125 nm thick PZT films prepared by the sol-gel technique	Texas Instruments Japan
30p-ME-6	Preparation of PZT thin films from chemically amplified photosensitive sol-gel solution	Mitsubishi Materials, Rohm
30p-ME-7	Preparation of Pb-based ferroelectric thin films by the sol-gel method	Rohm, Mitsubishi Materials
30p-ME-8	Study of PZT thin films for application to NDRO nonvolatile memories	Rohm
30p-ME-9	CV characteristics of sol-gel ferroelectric PZT thin film capacitors	Olympus Optical, University of Colorado

-- continued on page 20

CONFERENCE REPORTS

PAPERS PRESENTED AT OYO BUTSURI GAKKAI -- SPRING 1994 MEETING

--continued from page 19

30p-ME-10	IV characteristics of sol-gel ferroelectric PZT thin film capacitors (2)	Olympus Optical, University of Colorado
30p-ME-11	Fatigue characteristics of sol-gel ferroelectric PZT thin film capacitors	Olympus Optical, University of Colorado

75 presentations on High ε_r materials

PZT	(28)	$SrTiO_3$	(12)	$Bi_4Ti_3O_{12}$	(3)
PLZT	(4)	$BaSrTiO_3$	(7)	$BaMgF_4$	(3)
$PbTiO_3$	(3)	$BaTiO_3$	(1)	$LiNbO_3$	(2)
PLT	(2)	$BaTiO_3/SrTiO_3$	(2)	Ta_2O_5	(2)
PbO	(1)	$Sr(Nb,Ti)O_3/SrTiO_3$	(1)	TiO_2	(2)
$PbZrO_3/PbTiO_3$	(2)			$KNbO_3$	(1)
$PZT/PbTiO_3$	(2)				

26 presentations on MOCVD

MOCVD	(26)
Sputtering	(13)
Sol-Gel	(12)
PLD	(8)
Evaporation	(4)
MBE	(4)
Other	(1)

University - National Laboratory	(55)
Industry	(60)

11TH MEETING ON FERROELECTRIC MATERIALS &THEIR APPLICATIONS IN JAPAN

The Eleventh Meeting on Ferroelectric Materials and Their Applications (FMA-11, General Chairman A. Kawabata, Toyama Prefecture University; Program Chairman Y. Ishibashi, Nagoya University; Executive Chairman T. Shiosaki, Kyoto University) was held from 25 to 28 May 1994 at Coop-Inn Kyoto, Kyoto. The FMA has been held every year since 1992 (until then, once every two years). About 310 participants from academic and industrial communities attended the meeting, where 118 ten-minute lectures, selected from about 140 proposals, were given in 19 plenary sessions, as well as an invited lecture given by Professor Eiji Mori, Takushoku University, who talked on "Aiming at Establishing Power-Ultrasonic Engineering."

FMA covers all application aspects of ferroelectric materials. As a notable trend in recent years, however, the number of contributions on thin films has increased rapidly, amounting to 48 papers this year. Another area of great interest is piezoelectrics—materials and applications—with 22 presentations given at the meeting on this subject.

The lectures delivered at FMA-11 will be published as regular papers in a special issue of the *Japanese Journal of Applied Physics* in September (*JJAP* Vol.34, No.9B, 1994) after being refereed according to the publication standard of *JJAP*. With respect to this quick publication of papers, the great cooperation and hard work of the designated referees should be especially mentioned, and the organizers of FMA-11 are very thankful to them.

The FMA-12 will be held at Coop-Inn Kyoto, Kyoto, from 24-27 May 1995.

Y. Ishibashi
Program Chairman of FMA-11
Nagoya University

☐

IEEE THIN FILM FERROELECTRIC GLOSSARY

At theMonterey ISIF meeting in March 1994 it was decided to develop a glossary of ferroelectric thin film terms. The following list is the beginning of that project. The items have been grouped by categories to facilitate their assignment to committee members for definition. The actual glossary will most likely be alphabetized without categories. Please add any other terms that have been left out and return your additions by E-mail to Russell Lipeles. His address on the Internet is: russelllipeles@aero.org ***See list of terms on p. 21***

THEORY; GLOSSARY

DEVELOPMENTS AND TRENDS IN THE UNDERSTANDING OF FERROELECTRICITY

The search for the microscopic origin of the phenomenon of ferroelectricity is not only scientifically interesting but would also help in enlarging the field of applications of ferroelectrics, as material properties could be optimized if sound theories provide a basic understanding. Contrary to the general belief during the last decades that ferroelectrics are purely ionic systems, new numerical techniques and standard lattice dynamical calculations provide strong evidence that an ionic picture fails to describe dynamical as well as static properties. The standard description of the dynamics of ferroelectrics in terms of a soft mode caused by anharmonic lattice interactions accounts only for a qualitative understanding but fails to reproduce experimental data quantitatively. Furthermore, it is not clear from that proposal why anharmonic interactions are present and dominant in ferroelectrics but not observed in multiple other compounds.

A large step in understanding the mechanism causing ferroelectricity was made at the end of the '70s by a phenomenological lattice dynamical model which included electronic degrees of freedom and introduced the concept of dynamical covalency.

This dynamical covalency has attracted much attention and a series of first principles calculations followed that idea. The main results are summarized in “First Principles Calculations in Ferroelectrics.”

The Third Williamsburg Workshop on First-Principles Calculations for Ferroelectricity in February 1994 yielded — for the first time — a certain convergence in the theoretical understanding of ferroelectricity. Specifically it can be concluded that ferroelectrics are not purely ionic but have a high degree of covalent bonding. This covalency is mainly due to the delocalization of oxygen-p-states which favor a crucial p-d hybridization and a strong directional bonding. In oxide perovskites, for example, the cubic structure becomes unstable with respect to a lattice mode involving oxygen versus transition metal displacements due to the directional preference of the p-d-bonding character.

From the present theoretical knowledge it can be concluded that to design optimal ferroelectric properties the combination of oxygen ions with transition metal compounds in high symmetry complex structures is best suited to stabilize polar properties. Various material properties still require further research and perhaps the most famous example is represented by hydrogen bonded ferroelectrics which still await basic understanding.

A. Bussmann-Holder
Max-Planck-Institut für Festkörperforschung
Heisenbergstraße 1, 70569 Stuttgart, Germany

IEEE FERROELECTRIC THIN FILM GLOSSARY -- continued from page 20

Device Terms
barrier layer
bit line
FEDRAM
FEMFET
FERRAM
FETFT
blocking electrode
DRO
internal field
NDRO
negative read
negative write
resistivity
Schottky barrier
space charge
word line

Materials
SBN
BST
PLZT (x/y/z)
PZT (x/y)
Y1
YZ

Processing
anneal
annealing
bake
buffer layer
consolidate
CVD
dry
glue layer
ILD
LSCVD
MOD
metallic electrode
oxide electrode

Processing, *cont.*
passivation
PLD
sinter
sol-gel
substrate
template
top electrode
forming gas treatment
oxygen anneal

Ferroelectric
A-site
B-site
Curie temperature
domain
ferroelectric
hysteresis
perovskite
polarization
pole
saturation

Measurement
ΔP_0
ΔP_1
$\Delta P_r(t)$
ΔP_S
aging
bottom electrode
capacitance
coersive field
E_c
endurance
fatigue
hysteresis loop
imprint
leakage
nonremenant polarization
P_{max}
positive read
positive write
pulsed test

Measurement, *cont.*
PUND
retained polarization
V_{max}

UPCOMING MEETINGS

Ceramic Processing Science and Technology
11 - 14 September 1994
Friedrichshafen (Bodensee), Germany

This international conference continues the series of previous **Ceramic Powder Science Conferences** in Orlando (1987), Berchtesgaden (1988), San Diego (1990), and Nagoya (1991). The scope of the conference has been enlarged in order to reflect the total spectrum of ceramic processing and technology. Besides the various routes for processing bulk ceramics, aspects of quality assurance and computer application in ceramic processing will be discussed. The conference will include invited lectures and contributed papaers (oral presentations and posters). The official langiuage of the conference is English.

Topics

- Ceramics from powders (powder synthesis, forming, densification)
- Powderless processing (organometallic route, reaction sintering processes, sol-gel ceramics)
- Production and properties of ceramic fibers
- Processing methods for microstructural design (nanoceramics, in-situ composites, gradient materials)
- Quality assurance in ceramic processing
- Computer application in ceramic processing

Program Chairs

H. Hausner, Technische Universität Berlin, Germany
S. Hirano, Nagoya University, Japan
G.L. Messing, Pennsylvania State University, USA

Sponsors

German Ceramic Society (Deutsche Keramische Gesellschaft e.V.)
American Ceramic Society
Ceramic Society of Japan
European Ceramic Society
Endorsed by the International Ceramic Federation

Contact

Deutsche Keramische Gesellschaft
Frankfurterstraße 196, D-51147 Köln, Germany, Phone +49-2203-69069, Fax +49-2203-69301

2nd Pacific Rim Conference on Ferroelectric Applications
21 - 24 November 1994
Royal Melbourne Institute of Technology, Melbourne, Victoria, Australia

This conference is a sequel to the successful workshop held in Taejon, Korea, in October 1993 and is expected to be an annual event, rotating among Pacific Rim countries.

Topics

Ferroelectric thin films	Nonvolatile memories	Microwave devices, e.g., phase shifters
Processing & deposition	High dielectric DRAMs	Integrated optics and eletrooptics
Device integration		

Co-Chairs

Prof. S.I. Woo, Taejon, Korea — Prof. T. Shiosaki, Kyoto, Japan — Prof. J.F. Scott, Melbourne, Australia

Proceedings

The conference proceedings will be published in *Integrated Ferroelectrics.*

Contact

Prof. J.F. Scott, Faculty of Applied Sciences, RMIT, GPO 2476V, Melbourne, Victoria 3001, Australia,
Fax +61-3-660-3747

UPCOMING MEETINGS

1994 IEEE Ultrasonics Symposium
1 - 4 November 1994
Cannes, France

Topics

Array and beam steering
Acousto-electric effects & devices
Acoustic charge transport
Acoustic emission
Acoustic microscopy
Acousto-optic effects & devices
Acousto-optic signal processing
Bioeffects and biophysics
Bulk wave effects & devices
Defect & material characterization
Exposimetry/dosimetry
Flow measurement
Geophysical acoustics
Hyperthermia
High temperature superconductors
Intelligent process monitoring
Inverse scattering
Industrial ultrasonics
Medical imaging
Medical probes & catheters
Medical ultrasonics signal processing
Magentostatic waves & devices
Nondestructive evaluation
NDE signal processing
Physical acoustics
Photo acoustics
Piezoelectric & ferroelectric materials
Quantitative laser ultrasonics
SAW commercial applications
SAW consumer electronics
Sensors
Sonically enhanced processing
SAW filters & transducers
SAW integrated-optic effects & devices
SAW military and aerospace applications
Smart materials and structures
SAW manufacturing technology
Speckle
SAW propagation
SAW resonator & delay line oscillators
SAW signal processing
SAW substrates & thin film materials
SAW thin film devices
SAW wireless communication
Tissue characterization
Thin films (bulk & optical devices)
Therapeutics
Tomography
Tissue motion & compliance
Underwater acoustics
Ultrasonic actuators & motors
Ultrasonic acoustics
Ultrasonic in surgery

Sponsor

The IEEE Ultrasonics, Ferroelectrics & Frequency Control Society

Contact

Dr. Susan C. Schneider, Marquette University, Dept. of Electrical & Computer Engineering, Milwaukee, WI 53233, Phone (414) 288-7178, Fax (414) 288-7082

55th Autumn Meeting of the Japan Society of Applied Physics
19 - 22 September 1994
Nagoya City, Japan

This four-day meeting of the Japan Society of Applied Physics is held at Meijo University in Nagoya City, Aichi Prefecture, and is the second of the biannual meetings of the Society. A detailed report on the 1994 Spring meeting is published on pages 15 - 20 in this issue of the *Ferroelectricity Newsletter*.

Contact

The Japan Society of Applied Physics
Kudanshita Building, 1-12-3 Kudan-kita, Chiyoda-ku, Tokyo 102
Phone +3-3238-1044, Fax +3-3221-6245

CALENDAR OF EVENTS 1994

Aug 7-10	• 9th IEEE Internat. Symposium on the Applications of Ferroelectrics, University Park, PA (see *F. Newsletter* Vol. 1, No. 4, p. 8)
9-11	• 3rd Asian Regional Seminar on Microelectronics and Information Technology, Bangkok (see *F. Newsletter* Vol. 2, No.1, p. 10)
23-27	• 5th Russian-Japanese Symposium on Ferroelectricity, Moscow (see *F. Newsletter* Vol. 2, No. 2, p. 10)
29- Sep 2	• Internat. Symposium on Ferro- and Piezoelectric Materials and Their Application '94, Moscow (see *F. Newsletter* Vol. 2, No. 1, p. 10)
20- Sep 10	• International Exhibition on Ferro- and Piezotechnics '94, Moscow (see *F. Newsletter* Vol. 2, No. 1, p. 10)
Sep 5-7	• Electroceramics IV, Aachen, Germany (see *F. Newsletter* Vol. 1, No. 4, p. 9 and this issue p. 14)
6-9	• 3rd International Symposium on Domain Structure of Ferroelectrics and Related Materials (ISFD-3), Zakopane, Poland (see *F. Newsletter* Vol. 1, No. 4, p. 10)
7-9	• 8th International Symposium on Electrets (ISE 8), Paris (see *F. Newsletter* Vol. 2, No. 1, p. 10)
11-14	• Ceramic Processing Science and Technology, Friedrichshafen, Germany (see p. 22)
12-15	• 6th Internat'l Seminar on Ferroelastic Physics, Voronezh, Russia (see *F. Newsletter*, Vol. 2, No. 2, p. 11)
19-22	• 55th Autumn Meeting of the Japan Society of Applied Physics, Nagoya City, Japan (see p. 23)
Oct 11-15	• Ceramitec 94, Munich, Germany (see p. 9)
Nov 1-4	• 1994 IEEE Ultrasonics Symposium, Cannes, France (see p. 23)
21-24	• 2nd Pacific Rim Workshop on Ferroelectric Applications, Melbourne, Australia (see *F. Newsletter* Vol. 2, No. 1, p. 10 and this issue, p. 22)
28-Dec 2	• MRS 1994 Fall Meeting, Boston (see *F. Newsletter,* Vol. 2, No. 2, p. 11)
	1995
May 24-27	• 12th Meeting on Ferroelectric Materials and their Applications (FMA-12), Coop-Inn, Kyoto, Japan
Jul 4-8	• 8th European Meeting on Ferroelectricity, University of Nijmegen, The Netherlands. For information contact Mrs. Rina Vos, Secretariat EMF8, Institute for Theoretical Physics, University of Nijmegen, Toernooiveld, 6525 ED Nijmegen, The Netherlands

RETURN POSTAGE GUARANTEED

SPACE SYSTEMS ACADEMIC GROUP
CODE SP
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CA 93943